Enclosure 1

Indiana's Air Quality Modeling Protocol - Data Requirements Rule for the 2010 Primary 1-Hour Sulfur Dioxide Addressing the National Ambient Air Quality Standard (NAAQS)

June 2016

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Table of Contents

1.0 1-Hour Sulfur Dioxide National Ambient Air Quality Standard …….. 1

2.0 Data Requirements Rule (DRR) ……..... 2

3.0 Methodology for the DRR Air Quality Modeling ……... 4

4.0 Model Selection for the DRR Air Quality Modeling …… 4

4.1 AERMOD ……...……..……...…… 4

4.2 AERMAP ……...……..…… 5

5.0 Receptor Grid and Modeling Domain ……...…….5

6.0 Meteorology ……...…….…..6

6.1 AERMET ……...…….……...…… 6

6.2 AERMINUTE/AERSURFACE ……..…… 6

7.0 SO_2 Background Concentrations …...…….... 7

8.0 Overview of SO_2 Emissions Sources to be Modeled ....…… 8

8.1 DRR Sources ..…….……..…..……..8

8.2 Inventory Sources …..……..……..…..……...….. 8

8.3 Intermittent Sources …..……..……..…..……...…..9

9.0 Overview of Analysis of Modeling Results ….……...…… 10

Appendices

Appendix A Indiana's Data Requirement Rule Sources

1.0 Duke – Gallagher ……...…….……..…..……. A-1

2.0 NIPSCO – Schahfer ……..……..…..……...……. A-5

3.0 ArcelorMittal – Indiana Harbor /Coke Energy / U.S. Steel …….……..…… A-8

4.0 ArcelorMittal - Burns Harbor ….……..…..…….…… A-14

5.0 SABIC Innovative Plastics …….……..…..…….. A-19

6.0 Hoosier Energy – Merom ….……..…..……...……..... A-24

7.0 Duke – Cayuga …….……..…..……..... A-28

8.0 Alcoa – Warrick Power Plant …….……..…..…….…… A-31

9.0 Alcoa – Warrick Operations …….……..…..…….……..……. A-35

10.0 Isolatek ….……..…..…….……..…… A-36

Appendix B

1-Hour Sulfur Dioxide Background Determination …… B-1

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Indiana's Air Quality Modeling Protocol - Data Requirements Rule for the 2010 Primary 1-Hour Sulfur Dioxide National Ambient Air Quality Standard

1.0 1-Hour Sulfur Dioxide National Ambient Air Quality Standard

The United States Environmental Protection Agency (U.S. EPA) established the 1-hour primary sulfur dioxide (SO_2) National Ambient Air Quality Standard (NAAQS) of 75 parts per billion (ppb), based on the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations, as stated in the Federal Register Volume 75, Number 119, page 35520, published June 22, 2010. For air quality modeling purposes, the Indiana Department of Environmental Management (IDEM), Office of Air Quality (OAQ) will use an equivalent 1-hour SO_2 NAAQS of 196.2 micrograms per cubic meter ($\mu g/m^3$) as stated in the November 7, 2011, Federal Register, Volume 76, Number 215. This is based on the 5-year average of the annual 99th percentile of the 1-hour daily maximum modeled SO_2 concentrations, representing the fourth high of the 1-hour daily maximum SO_2 modeled concentrations.

Implementation of the standard began in 2013, when U.S. EPA made initial designations based on monitoring data. Subsequently, on March 2, 2015, U.S. EPA entered into a consent decree with the Sierra Club and the Natural Resources Defense Council concerning designations for other areas. Under the court order, U.S. EPA must complete the designations on a schedule that contains four specific rounds with specific deadlines. Each round of designations directly affects each state; the following areas must be addressed.

1) Areas that have current monitored design values in violation of the 2010 1-hour SO_2 NAAQS of 75 ppb;

2) As addressed in the "Round 2" Sierra Club and Natural Resources Defense Council consent decree: areas that contain sources that, according to U.S. EPA's Air Markets Database, either emitted more the 16,000 tons of SO_2 in 2012 or had emissions more than 2,600 tons of SO_2 and an emission rate of at least 0.45 lbs SO_2/MMBtu (pounds per one million British thermal units) in 2012;

3) Areas addressed under the Data Requirements Rule (DRR), which set an emissions threshold limit of 2,000 tons of SO_2 per year in 2014. Sources meeting this emission threshold will need to characterize air quality in the areas surrounding the source.

a.) The court's order directs U.S. EPA to complete area designations for the areas where states have not installed and begun operating a new SO_2 monitoring network under "Round 3" of the DRR by December, 2017.

b.) The court's order directs U.S. EPA to designate all remaining areas of the country under "Round 4" of the DRR by December, 2020.

2.0 Data Requirements Rule

This air quality modeling protocol will address requirements specific to the Data Requirements Rule (DRR) (Federal Register Vol. 80, No. 162, published August 21, 2015). Indiana identified eleven sources within the state that met the criteria established in the DRR of emitting 2,000 tons or more of SO_2 in 2014. This submittal was sent to U.S. EPA – Region V on January 7, 2016. On March 25, 2016, U.S. EPA subsequently identified six additional sources meeting the criteria for air quality characterizations under the DRR. Five of these sources are "consent decree" sources, which were modeled and analyzed as part of Round 2 designations. These sources have been listed since their 2014 SO_2 emissions exceeded the DRR threshold of greater than 2,000 tons per year. Information required for the designation of the areas around these consent decree sources has been previously submitted to U.S. EPA for review/consideration. Those DRR sources, the counties in which they reside and their 2014 SO_2 emissions are listed in Table 1:

Table 1: Indiana Sources Subject to the Data Requirements Rule

Facility	County	2014 SO_2 Emissions (tons)
Duke – Gallagher	Floyd	3,524
Duke - Gibson	Gibson	Air Markets Database source [a]
Isolatek (U.S. Minerals)	Huntington	< 2,000[b]
NIPSCO – R.M. Schahfer	Jasper	8,412
Indiana-Kentucky Electric Corporation—Clifty Creek Generating Station	Jefferson	Air Markets Database source [a]
ArcelorMittal – Indiana Harbor	Lake	2,163
Coke Energy	Lake	4,952
US Steel – Gary Works	Lake	3,285
NIPSCO - Michigan City	LaPorte	Air Markets Database source [a]
ArcelorMittal - Burns Harbor	Porter	12,189
SABIC Innovative Plastics	Posey	4,030[c]
Vectren—A.B. Brown Generating Station	Posey	Air Markets Database source [a]
AEP - Rockport	Spencer	Air Markets Database source [a]
Hoosier Energy – Merom	Sullivan	3,318
Duke – Cayuga	Vermillion	3,448
Alcoa – Warrick Power Plant	Warrick	4,993
Alcoa – Warrick Operations	Warrick	3,500[d]

[a] IDEM completed a characterization for this source under Round 2 designation requirements

[b] U.S. EPA added Isolatek to the list of Indiana sources subject to DRR on March 25, 2016

[c] SABIC is undergoing plant changes which will reduce their SO_2 emissions by January 13, 2017

[d] Alcoa – Warrick Operations shut down its smelter operations on March 31, 2016, reducing SO_2 emissions to < 1 ton

As per the requirements of the DRR, air agencies are required to indicate whether they will rely on 1) air quality modeling, 2) ambient monitoring or 3) establishing a limit of a source's total SO_2 emissions to below 2,000 tons per year, to characterize air quality in the area surrounding the DRR sources. Indiana has reviewed SO_2 modeled impacts from each source identified by the state and U.S. EPA as subject to the DRR and determined that eleven sources will conduct air dispersion modeling to characterize air quality in each area; one source, ArcelorMittal – Burns Harbor, has opted to rely on ambient monitoring to characterize air quality in the area.

U.S. EPA has established deadlines for each step of the 1-hour SO_2 designation process in the DRR. Indiana met the first deadline by submitting its list of DRR sources on January 7, 2016.

- **January 15, 2016 -** States were required to submit their list of SO_2 sources for characterizing air quality under the DRR to U.S. EPA.
- **July 1, 2016 –** States are required to submit modeling protocols for sources characterizing air quality in the area with air dispersion modeling.
- **July 1, 2016 –** Annual Monitoring Network Plans due to U.S. EPA and should include SO_2 monitoring network modifications intended to satisfy the DRR.
- **January 1, 2017 –** SO_2 monitors intended to satisfy the DRR are required to be operational.
- **January 13, 2017 –** States electing to characterize air quality by air dispersion modeling are required to provide modeling analyses to U.S. EPA.
- **January 13, 2017 –** Federally enforceable and permanent emission limits to keep source emissions below 2,000 tons of SO_2 must be adopted and effective by this date.
- **August 2017 –** Expected date by which U.S. EPA would notify states of intended designations.
- **December 2017 –** Intended date by which U.S. EPA would issue final designations for the majority of the country.
- **August 2019 –** Anticipated due date for state attainment plans for areas designated as nonattainment in 2017.
- **May 2020 –** Required certification of 2019 monitoring data; states have the opportunity to provide updated state recommendations to U.S. EPA.
- **August 2020 –** Expected date by which U.S. EPA would notify states of intended designations for reminder of the country not yet designated.
- **December 2020 –** Intended date by which the U.S. EPA would issue final designations for the remainder of the country.
- **August 2022 –** Anticipated due date for state attainment plans for areas designated nonattainment in 2020.

3.0 Methodology for the DRR Air Quality Modeling

The modeling methodology will resemble modeling used to evaluate New Source Review (NSR) and Prevention of Significant Deterioration (PSD) sources. However, U.S. EPA provided further guidance in order to conduct an appropriate air dispersion modeling analysis to support 1-hour SO_2 designation recommendations. U.S. EPA's SO_2 NAAQS Designations Modeling Technical Assistance Document (TAD) guidance has several recommendations for modeling methodology for determining attainment designations, including:

1) Use of actual emissions to assess modeled concentrations to reflect current air quality.

2) Use of 3 years of modeling results to calculate a simulated 1-hour SO_2 design value consistent with the 3-year monitoring period to develop 1-hour SO_2 design values.

3) Placement of receptors only in locations where an air quality monitor could be placed.

- Based on the SO_2 NAAQS Designations Modeling TAD, Section 4.2; Indiana will only place modeling receptors where feasible to place a monitor. Therefore, in bodies of water or an area where monitor citing criteria would not be reasonably met, Indiana will not place receptors in those locations.

- Indiana will match up the modeling domain with Google maps projections to ensure the proximity of the receptors to shorelines and provide details for each modeling analysis in the technical support document.

4) Use of actual stack heights rather than relying on Good Engineering Practice (GEP) stack heights when modeling actual emissions.

Indiana will follow U.S. EPA's designation modeling recommendations to conduct the 1-hour SO_2 designation modeling to determine whether there are modeled violations of the 1-hour SO_2 NAAQS. Modeling results will look at the 4^{th} high maximum daily 1-hour SO_2 concentrations averaged over the 3-year modeled period with representative temporally varying seasonal SO_2 background concentrations included within the AERMOD modeling run to determine the attainment status of the area where the emission source resides.

4.0 Model Selection

4.1 AERMOD Dispersion Model

In accordance with Appendix A of Appendix W to 40 Code of Federal Regulations (CFR) Part 51, Indiana will use the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) version 15181 for all dispersion modeling of the SO_2 emission sources mentioned in the DRR, and located in Floyd, Huntington, Jasper, Lake, Porter, Posey,

Sullivan, Vermillion and Warrick counties. U.S. EPA's SO_2 NAAQS Designations Modeling TAD, specific to the attainment designation modeling, recommends using actual stack heights when modeling actual emissions instead of following the good engineering practice (GEP) requirement. BPIPPRIME will be used to account for any building downwash concerns.

4.2 AERMAP

The AERMOD terrain preprocessor mapping program, AERMAP, will be used to determine all the terrain elevation heights for each receptor, building, and source locations using the Universal Transverse Mercator (UTM) coordinate system. The most recent AERMAP version 11103 will assign the elevations from the National Elevation Dataset (NED) using the North American Datum (NAD) 1983 as recommended in the, "40 CFR Part 51, Revision to the Guideline on Air Quality Models" Appendix W and later revised in the "AERMOD Implementation Guide." The Auer Land Use Classification Scheme will be used to determine land use in the area.

5.0 Receptor Grid and Modeling Domain

The receptor grid and modeling domain will be based on guidance provided in the memorandum "Updated Guidance for Area Designations for the 2010 Primary Sulfur Dioxide National Ambient Air Quality Standards", dated March 20, 2015 and the SO_2 NAAQS Designations Modeling TAD. Indiana proposes a multi-nested rectangular receptor grid with appropriate spacing of receptors based on the distance from the modeled emission points to detect significant concentration gradients. Indiana has conducted exploratory modeling on each of the DRR sources and does not anticipate maximum modeled 1-hour SO_2 impacts or source-culpable modeled violations to extend out beyond 10 kilometers from each source. In situations where multiple sources covered by the DRR must be evaluated in the same area, the modeling domain may be extended to include all sources and the appropriate distances to model maximum 1-hour SO_2 impacts to determine attainment designations for the area. Indiana proposes the following multi-nested rectangular receptor grid:

- Receptor spacing at the fence line for each facility will be placed every 50 meters.
- Receptor spacing at 100 meters out to a distance of 3,000 meters (3 kilometers) beyond each facility (grid may be extended if modeling results warrant).
- Receptor spacing at 250 meters out to a distance of 5,000 meters (5 kilometers) beyond each facility (grid may be extended if modeling results warrant).
- Receptor spacing at 500 meters out to a distance of 10,000 meters (10 kilometers) beyond each facility (grid may be extended if modeling results warrant).

6.0 Meteorological Data

6.1 AERMET

As stated in 40 CFR Part 51, Appendix W, section 8.3.1.2 and the SO_2 NAAQS Designations Modeling TAD, Indiana proposes to use three years (2012-2014) of National Weather Service (NWS) and on-site surface data and upper air meteorological data processed with the latest version of the AERMOD meteorological data preprocessor program AERMET (version 15181). Table 2 below lists the modeled facilities as mentioned in the DRR and the corresponding surface and upper air meteorological stations that will be used to conduct modeling.

Table 2: National Weather Service Stations/Onsite Meteorological Stations

Facilities	Surface Meteorology	Upper Air Meteorology
SABIC Innovative Plastics Alcoa – Warrick Power Plant Alcoa – Warrick Operations Hoosier Energy - Merom	Evansville, IN NWS	Lincoln, IL NWS
Duke – Gallagher	Louisville, KY NWS	Wilmington, OH NWS
Arcelormittal – Indiana Harbor Coke Energy US Steel – Gary Works ArcelorMittal Burns Harbor	Gary IITRI onsite meteorological data processed with South Bend, IN NWS	Lincoln, IL NWS
NIPSCO – R.M. Schahfer	South Bend, IN NWS	Lincoln, IL NWS
Duke –Cayuga	Indianapolis, IN NWS	Lincoln, IL NWS
Isolatek	Fort Wayne, IN NWS	Wilmington, OH NWS

Indiana will request the use of the adjusted surface friction velocity (adj_U*) beta option in order to more accurately model 1-hour SO_2 concentrations from DRR sources located in Lake and Warrick Counties.

6.2 AERMINUTE/AERSURFACE

The 1-minute wind speeds and wind directions, taken from the Automated Surface Observing System (ASOS) NWS stations and onsite meteorological stations, were processed with the U.S. EPA 1-minute data processor program AERMINUTE version 15272.

The U.S. EPA program AERSURFACE version 13016 was used to determine the surface characteristics; albedo, Bowen ratio, and surface roughness for the Indianapolis, Evansville, South Bend, Indiana and Louisville, Kentucky NWS meteorological tower locations. Surface

characteristics were determined at each NWS location for each of 12 wind direction sectors with a recommended default radius of one kilometer.

The albedo and the Bowen ratio surface characteristics were adjusted during the three winter months of January, February, and December in accordance with the U.S. EPA Region V document, "Regional Meteorological Data Processing Protocol," dated May 6, 2011. Additionally, a dry or wet Bowen ratio value was used during months when soil moisture conditions were abnormally dry or wet; otherwise the Bowen ratio value for average soil moisture conditions was used. The surface roughness value for snow cover was used if more than half of the month had days with at least one inch of snow on the ground. Otherwise, the no snow cover surface roughness value was used.

7.0 SO_2 Background Concentrations

The modeling of all DRR sources will use adjusted temporally varying seasonal background concentrations or concentrations without upwind major source SO_2 impacts. Each source will use 1-hour SO_2 monitoring data, taken from nearby monitors, considered representative of background concentrations for the area. Since most SO_2 monitoring sites located in the state are downwind of large SO_2 sources, impacts from the upwind direction of the large SO_2 source were removed from the monitoring data. The 99^{th} percentile SO_2 concentrations by season (winter, spring, summer and fall) for each hour of the day were calculated to determine the temporally varying seasonal SO_2 background, which were directly input into the model and were part of the final modeled results. This procedure was used to prevent double counting of SO_2 sources within the background concentration values used for this attainment designation modeling.

Temporally varying seasonal SO_2 background concentrations were developed in accordance with the recommended U.S. EPA guidance for establishment of such background concentrations in Section 8.2 of 40 CFR Part 51, Appendix W and considered appropriate and representative of the area. The latest three years of SO_2 air quality monitoring data (2012-2014) were used to develop background concentrations for each of the areas mentioned in the DRR, with the exception of the Larwill monitoring data in Whitley County. These data were taken from 2013 – 2015; the monitor began operation in January 1, 2013. The procedures used to develop the SO_2 background concentrations will be included as Appendix A. Table 3 shows the DRR facility and corresponding 1-hour SO_2 monitoring sites used for representative background concentrations in the air quality characterization.

Table 3: Indiana DRR Sources and Counties and Nearby Background Monitoring Sites

Facility	County	Monitoring Sites
SABIC Innovative Plastics	Posey	Evansville – Buena Vista
Alcoa – Warrick Power Plant Alcoa – Warrick Operations	Warrick	Evansville – Buena Vista / onsite data
Duke – Gallagher	Floyd	New Albany – Green Valley
NIPSCO – R.M. Schahfer	Jasper	Wheatfield
Hoosier Energy – Merom	Sullivan	Terre Haute – North Lafayette Road
Duke – Cayuga	Vermillion	Fountain County -North of State Road 234
ArcelorMittal – Indiana Harbor Coke Energy U.S. Steel – Gary Works	Lake	Gary IITRI and Hammond
ArcelorMittal - Burns Harbor	Porter	Dunes Acres Substation
Isolatek	Huntington	Larwill

8.0 SO_2 Emissions Sources to be Modeled

8.1 DRR Sources

Indiana proposes to model the hourly continuous emissions monitoring (CEM) data taken from the electric generating units (EGUs) sources subject to the DRR. Along with the hourly SO_2 emission data, any hourly variable stack gas flow rate, and temperature of the exhaust stream may also be modeled if available. This variation in parameters may influence dispersion characteristics of the exhaust stream and impact modeled 1-hour SO_2 concentrations.

For the emission sources which do not have CEM data, actual emissions taken from the latest available emissions reporting will be used. The SO_2 NAAQS Designations Modeling TAD, Section 5 will be referenced to best characterize any temporal and/or seasonal variability of emissions. This would include any seasonal, monthly, or daily variations that can be quantified. Specific emissions characterization that will be modeled will be addressed for each DRR source later in this document.

There are instances where sources emitted less than 2,000 tons of SO_2 in 2014 and are not listed as a DRR source, but are located in the vicinity of a DRR source and the modeling receptor grid. This will be considered a cluster source and the source will be evaluated along with the DRR source in the air quality modeling analysis.

8.2 Inventory Sources

Based on the U.S. EPA memo, "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard, page 16", dated

March 1, 2011; Indiana is focused on the characterization of air quality within 10 kilometers or less for each of the DRR sources. U.S. EPA's SO_2 NAAQS Designations Modeling TAD Section 4.1, page 7 mentions the number of sources to be explicitly modeled should cause a significant concentration gradient and the number of those sources to be modeled would generally be small. Indiana retrieved a list of all SO_2 emission sources in the county of the DRR source, as well as larger SO_2 emission sources in adjacent counties and states that were determined to be explicitly modeled.

Emission sources near the DRR source will be evaluated to determine if those sources could cause or contribute to a NAAQS violation. Indiana proposes to use the following thresholds: sources with SO_2 emissions greater than 250 tons per year and located within 30 kilometers of the DRR source will be used as a screening method to narrow the focus of sources which would have realistic modeled impacts that would impact attainment designations. While this method is applied on an area by area basis, Indiana feels this is an accurate representation of air quality in the area, especially since the hourly seasonal background concentrations would adequately capture surrounding source SO_2 impacts. IDEM identified sources with emissions less than 250 tons that were included in DRR modeling due to their proximity within the DRR source receptor grid used in the dispersion modeling. Actual emissions taken from the latest available emissions inventories will be modeled for sources identified by these threshold levels to determine air quality characteristics in the area.

8.3 Intermittent Sources

Emergency generators, fire pumps, and startup/shutdown emissions will be handled consistent to the March 1, 2011 guidance "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS" from Tyler Fox, dated March 1, 2011. This guidance will be followed to assess the 1-hour SO_2 attainment designations as well. U.S. EPA recommends using appropriate data based on emissions scenarios that are continuous enough or frequent enough to contribute significantly to the annual distribution of maximum daily 1-hour concentrations. Review of the hours of operations for combustion turbines, emergency generators, startup/shutdown, fire pumps, and other auxiliary operations associated with the sources mentioned in the DRR have been determined to operate much less than 500 hours per year and have random and infrequent schedules that cannot be controlled. Indiana feels the intent of the DRR is to determine the attainment status of the area surrounding large SO_2 emission sources, based on the actual emissions coming from the large units will be Indiana's main focus of the designation determinations. This approach is consistent with previous 1-hour SO_2 nonattainment and designation modeling submitted by IDEM to U.S. EPA.

9.0 Analysis of Modeling Results

The purpose of this modeling demonstration is to characterize air quality and determine area designations as it relates to attainment of the 1-hour SO_2 NAAQS in accordance with the DRR. The 99th percentile of the 1-hour daily maximum modeled concentrations represents the fourth high of the 1-hour daily maximum SO_2 modeled concentrations and will be averaged across three years to compare resulting concentrations to the 1-hour SO_2 NAAQS of 75 ppb (196.2 $\mu g/m^3$ although U.S. EPA has listed 196.4 $\mu g/m^3$ as the equivalent value to 75 ppb). Modeled concentrations include representative temporally varying seasonal 1-hour SO_2 background values to determine the overall impact from the DRR sources. This resulting concentration will be compared to the 1-hour SO_2 standard to indicate whether a modeled violation of the SO_2 NAAQS occurred. All concentrations that fall below the 1-hour SO_2 NAAQS will be determined to attain the standard and the area surrounding the DRR source will be recommended as attainment.

Appendix A

Indiana's 1-Hour SO_2 Data Requirements Rule Source-Specific Modeling Protocol

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1.0 - Duke – Gallagher Generating Station (18-043-00004)

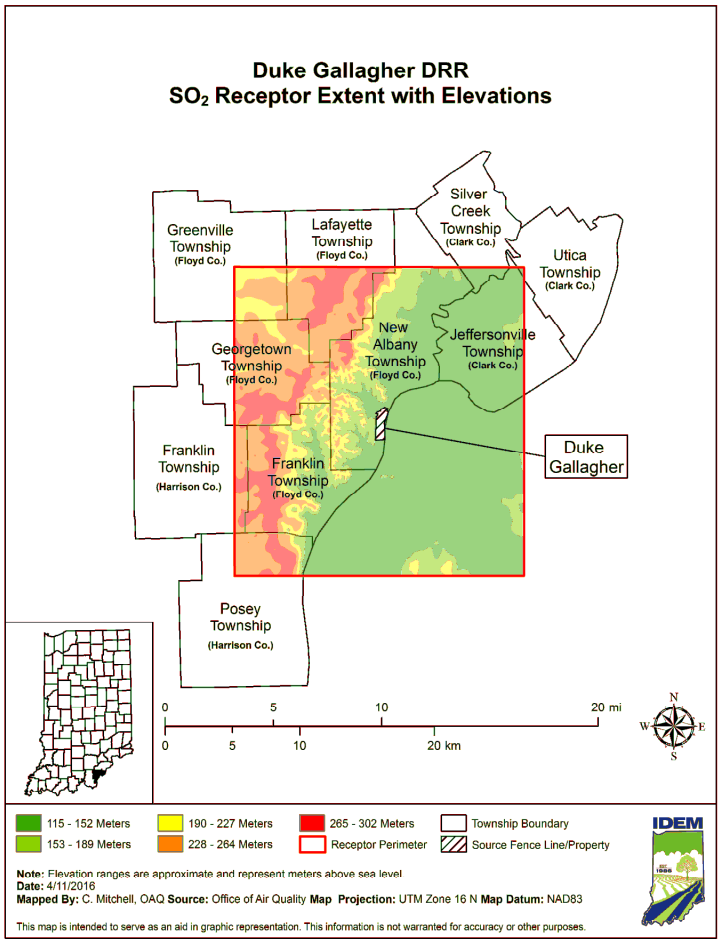
Source Description of DRR source

The Gallagher Generating Station (Gallagher Station) is a stationary electric utility generating station consisting of two units that have a capacity to generate 280 megawatts (MW) of electricity combined. Gallagher Station has two coal-fired boilers rated at 1,390 MMBtu/hr each. The plant is operated by Duke Energy Indiana, LLC.

Characterization of Modeled Area

The Gallagher Station is located at 30 Jackson Street, New Albany, New Albany Township, Floyd County, Indiana on the banks of the Ohio River; approximately 2 miles southwest of New Albany and 4 miles west of downtown Louisville, Kentucky. A map of the area and the receptor grid to be used for DRR modeling is shown below in Figure 10.1.

Figure 10.1 - Map of the Duke – Gallagher Generating Station and Surrounding Area



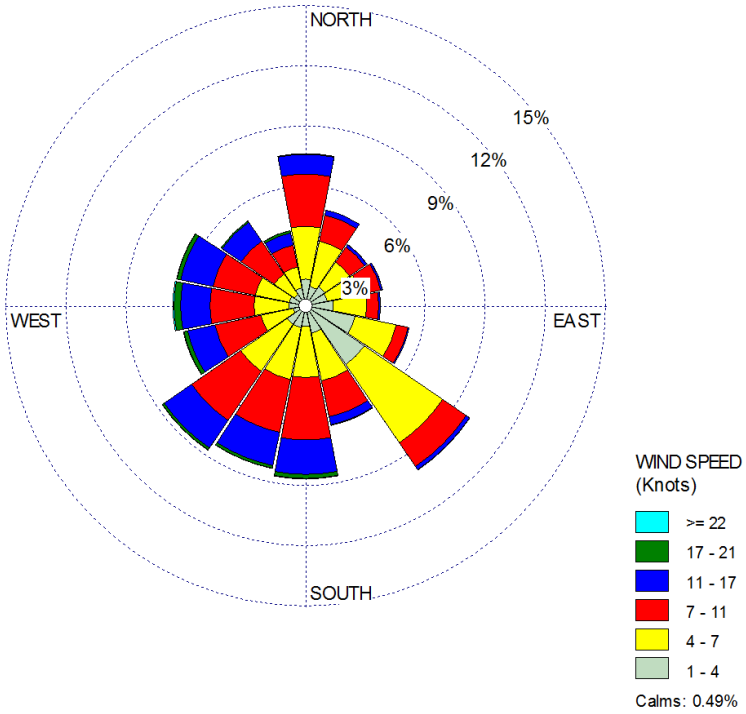
Model Options

All regulatory default options within AERMOD will be used to determine the air quality characteristics surrounding Gallagher Station. The Auer Land Use Classification Scheme was used to determine land use in the area. The area is considered primarily rural; therefore, a rural classification was used, as provided for in the Guideline on Air Quality Models, Section 7.2.3 (EPA, 2005b).

Meteorology/Wind Roses

Louisville, KY surface meteorological data and Wilmington, OH upper air meteorological data for the years 2012 – 2014 will be used to determine the air quality characteristics in the area surrounding Gallagher Station. Figure 10.2 shows the cumulative wind rose for 2012-2014 for the Louisville area.

Figure 10.2 – Louisville, Kentucky Wind Roses 2012-2014



Emissions Summary for Gallagher Station

Gallagher Station has two coal-fired units, Units 2 and 4 that have continuous emission monitoring (CEM) data for SO_2. This hourly CEM data from both units was formatted and used in the 1-hour SO_2 AERMOD model run.

Modeled Inventory Sources

SO_2 sources from the surrounding area were evaluated to determine if their SO_2 emissions impact the air quality surrounding the DRR source, beyond what is captured through background monitoring data. The latest available actual emissions were input for ESSROC and Louisville Medical Center Steam Plant. Louisville Gas & Electric facilities at Cane Run and Mill Creek have reduced SO_2 emissions through conversion of the coal-fired units to a natural gas combined cycle unit for Cane Run. The following list of sources, found below in Table 10.1 will be included in the AERMOD run to determine overall air quality characteristics.

Table 10.1 - Clark County, Indiana and Jefferson County, Kentucky: 1-Hour SO_2 Modeling Source Inventories

Source	Source ID	Location	2014 SO_2 Emissions (tpy)
ESSROC Cement Corporation	18-019-00008	Clark County, IN	416
Louisville Gas & Electric – Cane Run	21-111-00126	Jefferson County, KY	21
Louisville Gas & Electric – Mill Creek	21-111-00127	Jefferson County, KY	16,316
Louisville Medical Center Steam Plant	21-111-00148	Jefferson County, KY	451

Temporally Varying Seasonal 1-Hour SO_2 Background

Temporally varying seasonal 1-hour SO_2 background concentrations were taken from the New Albany – Green Valley, Floyd County, Indiana monitor and input directly into the AERMOD model run for Gallagher Station. Table 10.2 below lists the hourly seasonal 1-hour SO_2 values used for representative background concentrations for the area surrounding Gallagher Station.

Table 10.2 - 99th Percentiles for Temporally Varying Seasonal SO_2 Background Values (ppb) from the New Albany – Green Valley, SO_2 Monitor for 2012-2014

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	6.61	7.81	5.50	5.57	4.25	5.09	4.89	5.95
Spring	8.10	5.36	7.03	8.25	5.64	4.85	3.51	5.39
Summer	6.84	4.05	3.99	5.35	4.14	3.10	4.40	4.62
Fall	3.34	3.50	3.69	3.64	2.80	3.36	3.39	4.62

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	6.01	6.62	8.56	12.67	14.03	10.43	12.31	10.94
Spring	9.24	8.91	9.18	9.57	10.90	11.08	11.34	9.04
Summer	6.16	15.60	11.77	11.11	12.21	10.80	8.75	9.50
Fall	5.98	6.91	9.44	9.38	11.14	11.24	8.95	8.96

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	10.38	8.80	8.90	6.90	6.15	8.28	6.28	8.04
Spring	10.25	11.20	11.93	11.96	9.41	7.69	5.08	9.02
Summer	7.80	8.64	10.04	10.26	8.10	6.14	7.44	6.50
Fall	10.81	12.77	7.85	6.35	3.90	3.30	4.70	5.55

2.0 - NIPSCO – R.M. Schahfer Generating Station (18-073-00008)

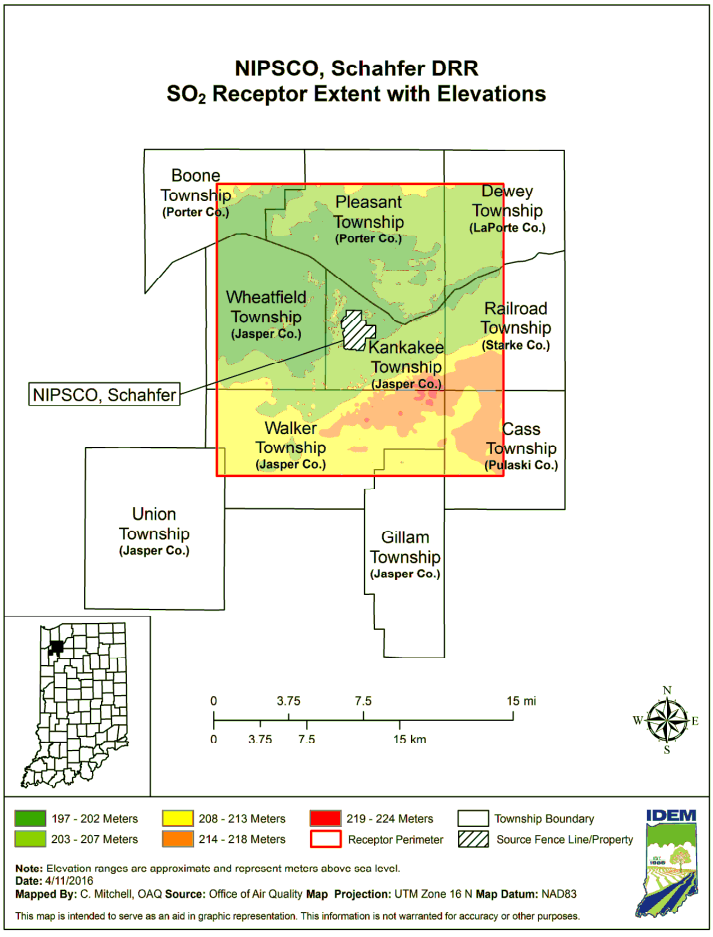
Source Description of DRR Source

The R.M. Schahfer Generating Station (Schahfer Station) is a stationary electric utility generating station consisting of four units that have a capacity to generate 1,943 megawatts (MW) of electricity combined. Schahfer Station has four coal-fired boilers; one boiler is rated at 4,650 MMBtu/hr, one boiler is rated at 5,100 MMBtu/hr, and two boilers are rated at 3,967 MMBtu/hr. The plant is operated by NiSource.

Characterization of Modeled Area

The Schahfer Station is located at 2723 East 1500 North, Wheatfield, in Kankakee Township, Jasper County, Indiana; approximately 5 miles west of State Road 421. A map of the area and the receptor grid used for DRR modeling is shown below in Figure 11.1.

Figure 11.1 - Map of the NIPSCO – Schahfer Generating Station and Surrounding Area



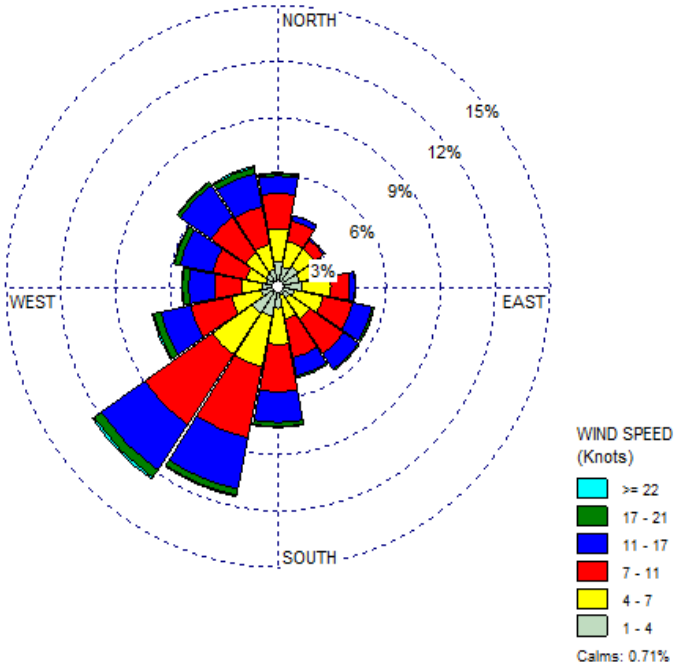
Model Options

All regulatory default options within AERMOD will be used to determine the air quality characteristics surrounding Schahfer Station. The Auer Land Use Classification Scheme was used to determine land use in the area. The area is considered primarily rural; therefore, a rural classification was used, as provided for in the Guideline on Air Quality Models, Section 7.2.3 (EPA, 2005b).

Meteorology/Wind Roses

South Bend, Indiana surface meteorological data and Lincoln, Illinois upper air meteorological data for the years 2012 through 2014 will be used to determine the air quality characteristics in the area surrounding Schahfer Station. Figure 11.2 shows the cumulative wind rose for 2012-2014 for the South Bend area.

Figure 11.2 - South Bend, Indiana 3-year Cumulative Wind Rose (2012 – 2014)



Emissions Summary for Schahfer Station

Schahfer Station has four units, Units BLR4, BLR15, BLR17, and BLR18 that have continuous emission monitoring (CEM) data for SO_2. This hourly CEM data from the four units were formatted and used in the 1-hour SO_2 AERMOD model run.

Modeled Inventory Sources

SO_2 sources from the surrounding area were evaluated to determine if their SO_2 emissions would impact the air quality surrounding the DRR source, beyond what is captured through background monitoring data. No inventory sources were found within 30 kilometers of Schahfer Station.

Temporally Varying Seasonal 1-Hour SO_2 Background

Temporally varying seasonal 1-hour SO_2 background concentrations were taken from the Wheatfield, Jasper County, Indiana monitor and input directly into the AERMOD model run for Schahfer Station. Table 11.1 below lists the hourly seasonal 1-hour SO_2 values used for representative background concentrations for the area surrounding Schahfer Station.

Table 11.1 - 99th Percentiles for Temporally Varying Seasonal SO_2 Background Values (ppb) from the Wheatfield SO_2 Monitor (2012-2014)

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	4.75	5.00	4.71	4.68	4.00	5.00	5.40	4.00
Spring	5.54	4.57	5.60	6.16	4.55	5.00	4.47	7.00
Summer	2.44	3.43	3.00	3.45	3.00	3.00	3.49	6.53
Fall	5.26	4.00	4.00	4.00	9.00	7.41	5.29	5.49

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	5.00	7.00	7.00	7.00	7.64	7.00	7.00	7.00
Spring	9.52	8.53	8.06	8.00	7.57	7.00	7.98	6.71
Summer	10.16	8.63	8.00	8.86	9.00	9.28	7.66	7.00
Fall	9.00	7.00	7.69	7.64	5.00	6.00	6.62	5.62

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	7.00	7.00	6.32	5.00	5.68	6.66	6.00	6.00
Spring	5.00	4.66	7.18	7.60	6.57	5.00	4.57	4.55
Summer	4.56	4.54	6.00	7.44	5.00	3.00	3.40	2.52
Fall	5.00	6.18	6.02	5.48	4.00	5.00	4.00	7.99

3.0 - Lake County: ArcelorMittal – Indiana Harbor (18-089-00318)/ Coke Energy (18-089-00383)/U.S. Steel (18-089-00121)

Source Description of DRR Sources

ArcelorMittal - Indiana Harbor is an integrated steel mill consisting of two blast furnaces, one sinter plant, one basic oxygen furnace (BOF) complex, one hot metal Reladle/Desulf complex, an 84 inch hot strip mill with three reheat furnaces, mill finishing and sheet finishing operations, plate mill furnaces, two coke batteries, and five power station boilers. Some processes such as the BOF steel making processes have roof monitor emissions in addition to stack emissions. The blast furnaces also have non-point slag pit loadout fugitive emissions which are modeled as volume sources.

CokeEnergy is an integrated steel mill consisting of one lime spray dryer Flue Gas Desulfurization unit and baghouse for the heat recovery coal carbonization facility (HRCC) waste gas stream operated by Indiana Harbor Coke Company (IHCC).

U.S. Steel is an integrated steel mill consisting of three coke batteries, a coke plant by-product recovery plant, one coke oven gas desulfurization facility, a coke plant boiler house, a sinter plant, four blast furnaces, two Basic Oxygen Process (BOP) shops with hot metal transfer and desulfurization stations, an 84 inch hot strip mill, a boiler house, and a TurboBlower boiler house. Some processes such as the BOF steel making processes have roof monitor emissions in addition to stack emissions. The blast furnaces also have non-point slag pit fugitive emissions which are modeled as volume sources.

Characterization of Modeled Area

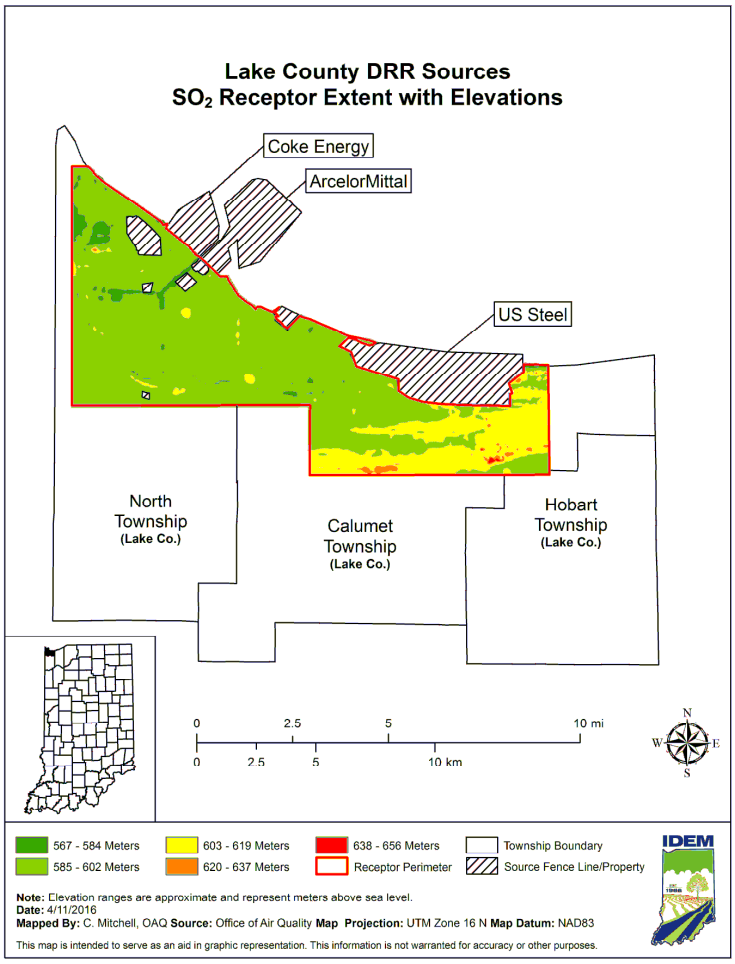
ArcelorMittal - Indiana Harbor is located at 3001 Dickey Road, East Chicago, in North Township, Lake County, Indiana. The northern end of the ArcelorMittal plant borders the southern shoreline of Lake Michigan.

Coke Energy is located at 3210 Watling Street, East Chicago, in North Township, Lake County, Indiana.

U.S. Steel is located at 1 North Broadway, Gary, in Calumet Township, Lake County, Indiana. The northern end of the U.S. Steel plant borders the southern shoreline of Lake Michigan.

Figure 12.1 below shows the property boundary of the facilities and the extent of the 10 kilometer modeling receptor grid into nearby townships. The 10 kilometer grid also extends northward into Lake Michigan. The receptor grid will be adjusted to remove the receptors which are located over Lake Michigan since this is an area where a SO_2 monitor could not be located as per the SO_2 NAAQS Designations Modeling Technical Assistance Document, Section 4.2.

Figure 12.1 - Map of the Lake County, Indiana DRR Sources and Surrounding Area



Model Options

ArcelorMittal - Indiana Harbor/Coke Energy/U.S. Steel will propose to use the adjustment to the surface friction velocity, (adj_U*), AERMET beta option in their modeling analysis. This will provide better model performance. Otherwise, all other regulatory default options will be selected to perform the air quality analysis for the three Lake County DRR facilities.

Urban Population

Population and city area data were taken from the 2010 census and city-data.com, which has moved to www.usa.com. Population density was calculated from this website. At least one-fourth of Gary Indiana's land area consists of a lime kiln facility and U.S. Steel. The density of Gary's population, excluding the area of U.S. Steel, is greater than 750 people per kilometer. The cities with populations greater than 750 people per square kilometer (Gary,

Hammond, East Chicago, Whiting, Munster, and Highland) were added together to obtain a population density value of 242,238 for the modeled area.

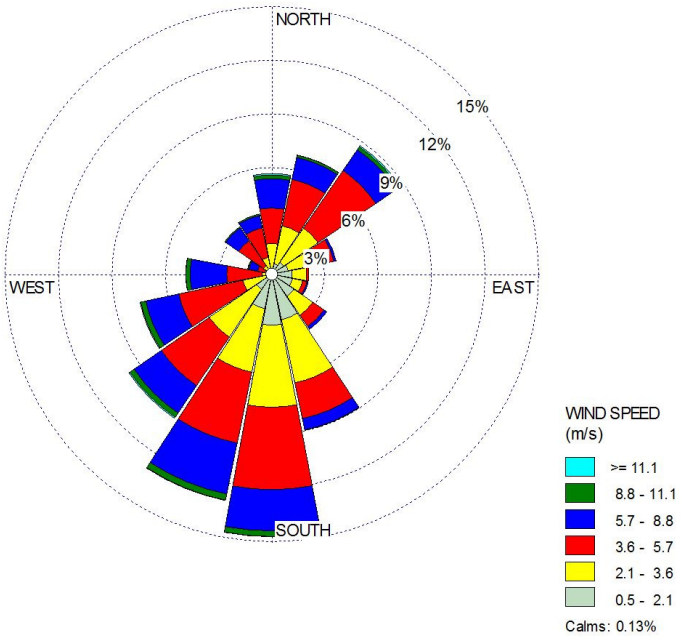
Receptors

Receptors are placed along each DRR source's plant property spaced 50 meters apart, and in a 100 meter grid out 5 kilometers from two points of peak impact. The first point is centered at the western modeled peak impact near Arcelor Mittal - Indiana Harbor, Coke Energy, and Indiana Harbor Coke Company; while the 2nd maximum modeled peak impact is centered at U.S. Steel. Beyond this is a 500 meter grid extending out 10 kilometers south and west of U.S. Steel. Beyond this, a coarser receptor grid of 1,000 meter grid extends out to the state and county lines.

Meteorology/Wind Rose

The Gary IITRI surface meteorological data and the Lincoln, Illinois upper air meteorological data taken from 2012 through 2014 will be used to determine the meteorological conditions surrounding the three Lake County, Indiana DRR sources in AERMOD. The Gary IITRI surface meteorological data will be used to more accurately include the influence of Lake Michigan on the meteorological conditions at and in the area immediately surrounding the three Lake County DRR facilities. The Gary IITRI wind rose for the 3-year modeled period is shown in Figure 12.2. The Gary IITRI wind rose depicts the predominant wind direction coming from the south to south southwest associated with the land breeze with the predominant wind direction associated with the lake breeze influence coming from the northeast.

Figure 12.2 - Gary IITRI 3-year Cumulative Wind Rose (2012 – 2014)



Emissions Summary for ArcelorMittal Indiana Harbor/Coke Energy/U.S. Steel

ArcelorMittal - Indiana Harbor will be modeled using several emission scenarios. The 201 stack has emission data collected by a continuous emission monitor; therefore, the CEM data will be modeled. There are several other processes with varying hourly emissions rates that will be based on a daily maximum emission rate. Emissions will be allocated for each hour of the day. Emission units without CEM data or daily emission records will be averaged across the three modeled years (2012-2014).

Modeled Inventory Facilities

The 2014 EMITS database of actual emissions for Lake County, Indiana was collected. Facilities in Lake County were included in this analysis if their 2014 SO_2 emissions totaled more than 40 tons of SO_2 per year. This approach accounts for 99.85% of SO_2 emissions from Lake County, Indiana for 2014. IDEM identified one source in the State of Illinois that emitted over 250 tons of SO_2 in 2014 located within 30 kilometers of the Lake County, Indiana sources. Two coal-fired power plants in Cook County, Illinois shut down in 2012, and as a result were not included in the modeling analysis. Two Porter County DRR SO_2 sources (ArcelorMittal – Burns Harbor and NIPSCO Bailly) were also included in the Lake County modeling analysis. The

following list of facilities in Table 12.1 will be included in the air quality modeling analysis to determine the overall SO_2 air quality impact in the area.

Table 12.1 - Lake County: 1-Hour SO_2 Modeling Inventory

Source	Source ID	Location	2014 SO_2 Emissions (tpy)
BP Products, North America Inc.	18-089-00003	Lake County, IN	554.4
Carmeuse Lime, Inc	18-089-00112	Lake County, IN	353.8
Cargill, Inc	18-089-00203	Lake County, IN	26.8
Eco Services Corp/Rhodia/Sovay USA Inc.	18-089-00242	Lake County, IN	288.4
ArcelorMittal USA	18-089-00316	Lake County, IN	1,588.0
Indiana Harbor Coke Company	18-089-00382	Lake County, IN	2,813.3
Ironside Energy LLC	18-089-00448	Lake County, IN	242.7
ISPAT Inland LaFarge North America	18-089-00458	Lake County, IN	106.7
ArcelorMittal – Burns Harbor	18-127-00001	Porter County, IN	12,189
NIPSCO Bailly Generating Station	18-127-00002	Porter County, IN	2012-2014 CEMS Data
Koppers Inc.	170000035076	Cook County, IL	1,785.7

Temporal Varying Seasonal 1-Hour Seasonal SO_2 Background

Temporally varying seasonal 1-hour SO_2 background concentrations were taken from the Gary IITRI (18-089-0022), Lake County SO_2 monitor and input directly into the AERMOD model for the three Lake County DRR sources. Table 12.2 shows the hourly seasonal 1-hour SO_2 concentrations in parts per billion (ppb) which represents the background concentrations for the northern Lake County, Indiana area.

Table 12.2 - 99th Percentile Temporally Varying Seasonal SO_2 Background Concentrations (ppb) from Gary IITRI SO_2 Monitor (2012-2014)

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	9.10	7.94	6.22	5.67	8.68	7.08	8.28	7.57
Spring	7.46	7.61	8.17	6.64	8.86	6.91	7.20	9.69
Summer	4.05	3.21	4.94	4.58	4.00	3.52	8.64	8.07
Fall	5.55	7.15	6.15	5.60	6.78	5.05	8.09	8.50

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	8.63	9.71	8.88	10.02	9.94	8.28	10.96	8.75
Spring	9.31	9.15	9.12	9.92	9.15	8.70	8.03	8.20
Summer	10.81	10.55	8.50	7.24	8.22	6.15	5.44	7.16
Fall	11.41	11.78	10.04	8.60	9.16	8.88	9.20	8.32

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	9.53	8.03	8.52	8.64	6.88	8.07	9.40	9.26
Spring	7.16	7.85	6.45	4.74	7.65	7.30	8.84	5.80
Summer	5.59	4.56	4.20	2.86	2.34	2.70	4.10	4.15
Fall	5.33	6.59	6.80	7.16	8.22	8.53	6.89	6.70

4.0 - ArcelorMittal – Burns Harbor (18-127-00001)

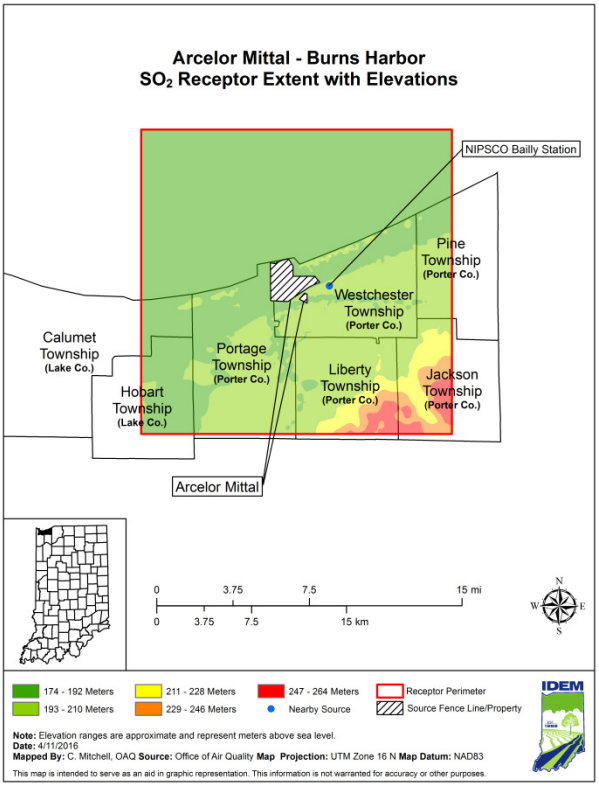
Source Description of DRR Source

ArcelorMittal - Burns Harbor (Burns Harbor) is an integrated steel mill consisting of two blast furnaces, three hot strip mill furnaces, plate mill furnaces, two coke batteries, three basic oxygen furnaces (BOF) hot metal desulfurization steel making processes, five power station boilers, and a sinter plant. There are also two blast furnace gas flares and a clean coke oven gas flare which emit a small amount of SO_2. Some processes, such as the BOF steel making processes, have roof monitor SO_2 emissions in addition to stack SO_2 emissions. The blast furnaces also have non-point slag pit loadout fugitive SO_2 emissions which are modeled as volume sources.

Characterization of Modeled Area

ArcelorMittal – Burns Harbor is located at 250 West U.S. Highway 12, Burns Harbor, in Westchester Township, Porter County, Indiana. The northern end of the Burns Harbor plant borders the southern shoreline of Lake Michigan. Figure 13.1 below shows the property boundary of the facility and the extent of the 10 kilometer modeling receptor grid into nearby townships and eastern Lake County, Indiana.

Figure 13.1 - Map of ArcelorMittal – Burns Harbor and Surrounding Area



The 10 kilometer grid also extends northward into Lake Michigan. The receptor grid will be adjusted to remove the receptors which are located over Lake Michigan since this is an area where an SO_2 monitor cannot be located.

Model Options

ArcelorMittal – Burns Harbor will propose to use the regulatory default options to perform the air quality analysis for the ArcelorMittal – Burns Harbor facility in order to appropriately site a SO_2 monitor to characterize air quality in the areas surrounding Burns Harbor.

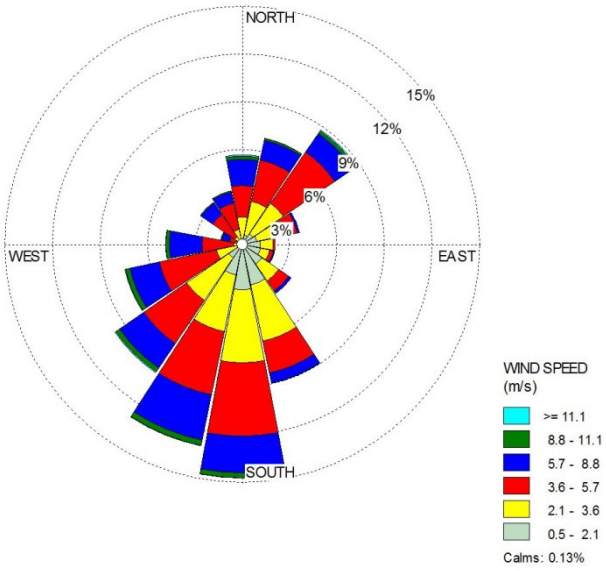
Air Quality Monitoring Approach for ArcelorMittal – Burns Harbor

ArcelorMittal will propose to use the air quality monitoring approach to meet the Data Requirements Rule with an air quality analysis designed to help determine the proper site location(s) of the SO_2 monitor(s) based on the locations of maximum 1-hour SO_2 modeled impacts. The Auer Land Use Classification scheme will not be used at this time to determine land use in the area and consequently the rural versus urban classification.

Meteorology/Wind Rose

The Gary IITRI surface meteorological data and the Lincoln, Illinois upper air meteorological data, taken from 2012 through 2014, will be used to determine the meteorological conditions surrounding Burns Harbor in AERMOD. The Gary IITRI surface meteorological data will be used to more accurately include the influence of Lake Michigan on the meteorological conditions at and in the area immediately surrounding the ArcelorMittal – Burns Harbor facility. The Gary IITRI wind rose for the 3-year modeled period 2012-2014 is shown as Figure 13.2 on the following page. The Gary IITRI wind rose depicts the predominant wind direction coming from the south to south southwest associated with the land breeze with the predominant wind direction associated with the lake breeze influence coming from the northeast.

Figure 13.2 - Gary IITRI 3-year Cumulative Wind Rose (2012 – 2014)



Emissions Summary for ArcelorMittal – Burns Harbor

ArcelorMittal – Burns Harbor will model several of their processes with varying hourly emissions rates based on a daily maximum emission rate. Emissions will be allocated for each hour of the day. Emission units without daily emission records will be averaged across the three modeled years. This is considered a conservative approach, especially with the modeled results to be used to locate SO_2 monitors in the area to characterize air quality.

Modeled Inventory Facilities

Table 13.1 lists the sources that will be included in the air quality modeling analysis to determine the overall SO_2 air quality impact in the area. NIPSCO – Michigan City, located in LaPorte County and U.S. Steel – Gary Works in Lake County would be included in the modeling, however, since Burns Harbor is opting for the monitoring approach, these facilities will be accounted for in the Dune Acres SO_2 background monitoring data.

Table 13.1 - Porter and LaPorte Counties, Indiana: 1-Hour SO_2 Modeling Inventory

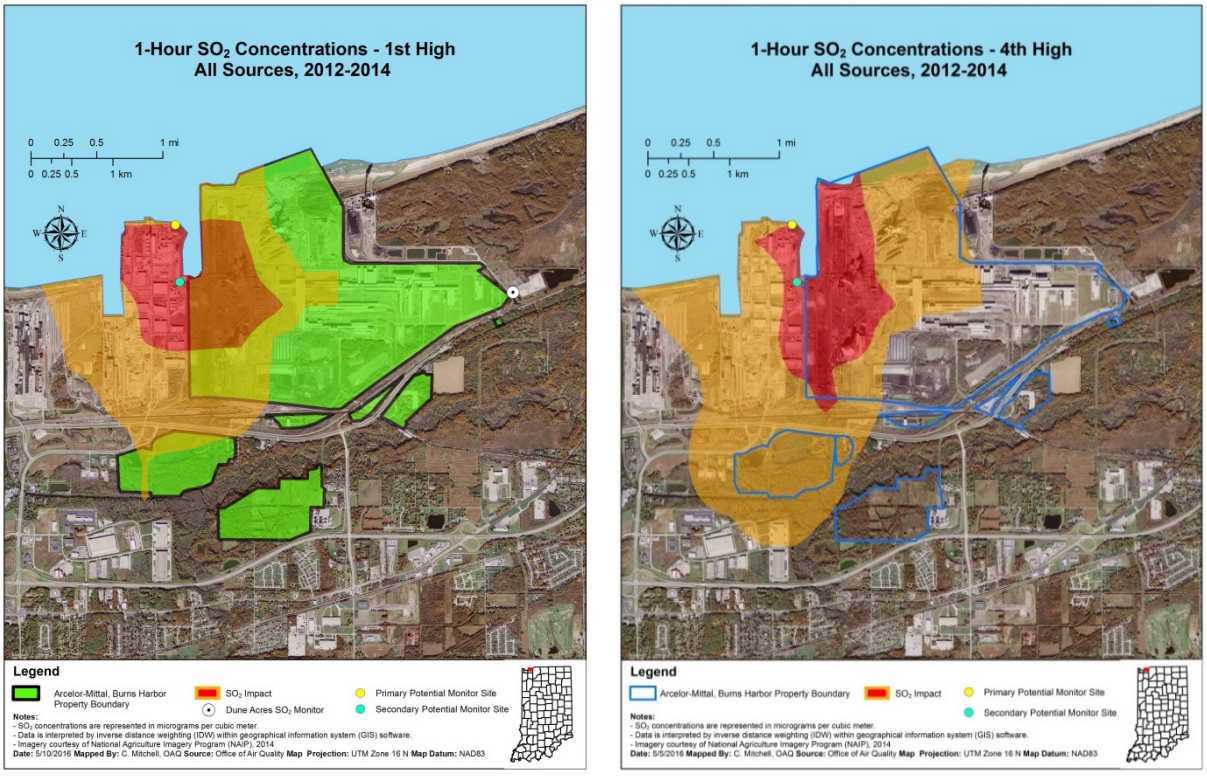
Source	Source ID	Location	SO_2 Emissions (tpy)
NIPSCO - Bailly Generating Station	18-127-00002	Porter County	2012-2014 CEMS Data
NIPSCO - Michigan City	18-091-00021	LaPorte County	2012-2014 CEMS Data
U.S. Steel – Gary Works	18-089-00002	Lake County	3,285 (2014)

Temporal Varying Seasonal 1-Hour Seasonal SO_2 Background

Temporally varying seasonal 1-hour SO_2 background concentrations were taken from the Dune Acres Substation (18-127-0011), Porter County SO_2 monitor and input directly into the AERMOD model for ArcelorMittal – Burns Harbor. Figure 13.3 shows the ArcelorMittal – Burns Harbor maximum 4th high SO_2 concentration over a 3-year modeled period, indicating definite maximum concentration gradients along the western property boundary of Burns Harbor, over the Port of Indiana area.

ArcelorMittal and IDEM have researched the Port of Indiana to determine appropriate locations for a SO_2 monitor. Two potential monitoring sites were found: a fishing area in the northern portion of the port and an existing lead monitoring site located directly west of the power stations and blast furnaces located at ArcelorMittal – Burns Harbor. These two potential monitoring sites fall within the maximum modeled 1st high and 4th high concentration zones, as shown in Figure 13.3 and would adequately characterize the air quality in the area.

Figure 13.3 – SO_2 Modeling Results for ArcelorMittal – Burns Harbor



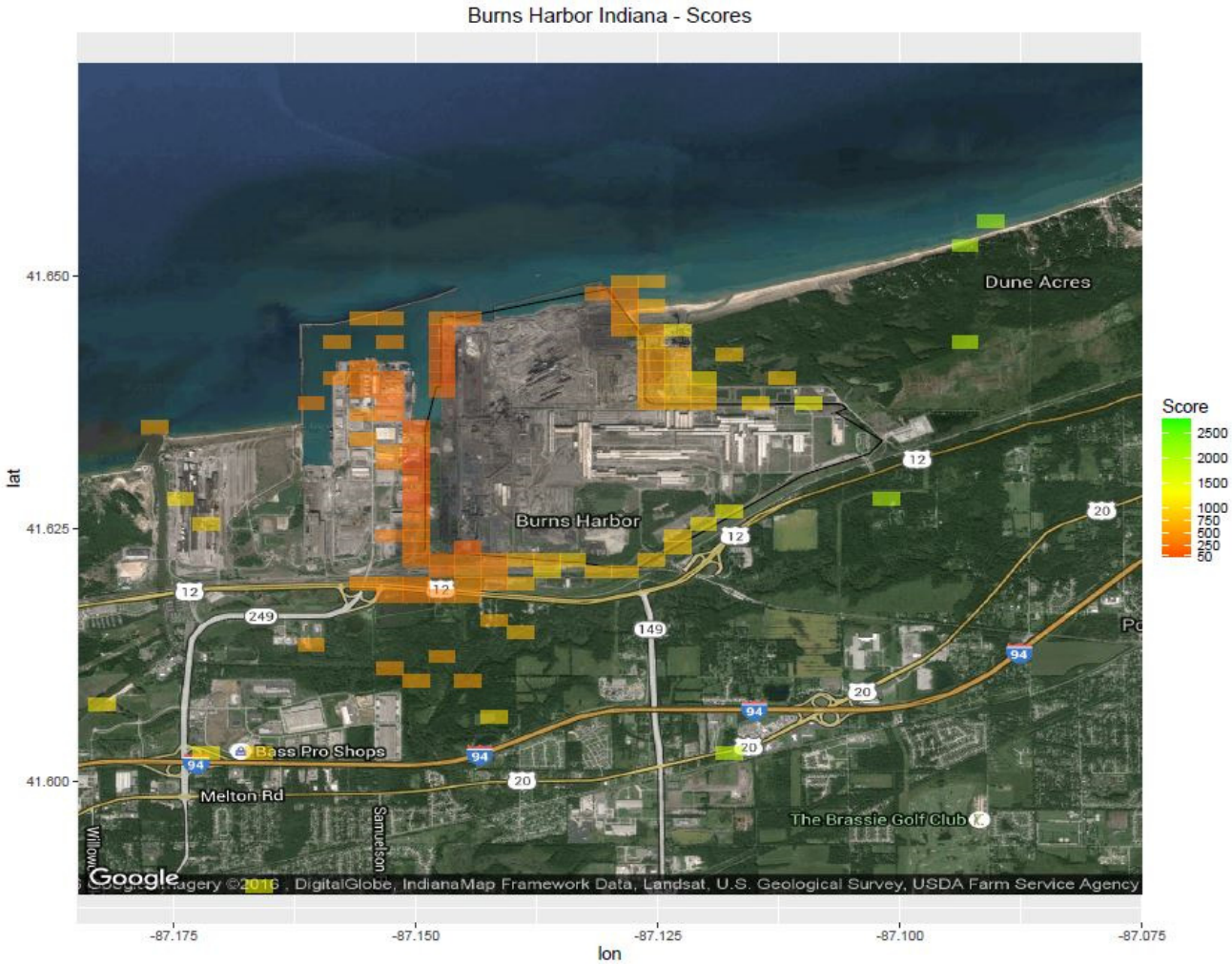
The modeling results for ArcelorMittal – Burns Harbor for both the maximum 1st and 4th high concentrations over the 3-year period of 2012 through 2014 match well with each other and

represents the impact from all SO_2 sources that best characterizes air quality in the area surrounding the facility.

Modeling to Inform Monitoring Placement

IDEM followed U.S. EPA's SO_2 NAAQS Designations Monitoring TAD, Appendix A to inform placement of ambient monitors. Elements of the Monitoring TAD, Appendix A, analysis were used to evaluate dispersion modeling results and the frequency of the highest maximum 4^{th} high modeled concentrations occurring along the west-northwest and western property lines of Burns Harbor. Figure 13.4 shows the scoring results based on the location and rank of the receptors based on the guidance. This evaluation provided valuable information in helping to establish a monitoring site that best characterizes air quality in the area surrounding Burns Harbor.

Figure 13.4 - Plot Map of Overall Scoring of Maximum Design Value/Frequency of Maximum Days



Clearly, an SO_2 monitor along the western property line of Burns Harbor will be positioned to capture any high concentrations coming from Burns Harbor and properly characterize the air quality in the area. The Port of Indiana is adjacent to Burns Harbor and would be appropriate to locate an ambient air monitor.

5.0 - SABIC Innovative Plastics (18-129-00002)

Source Description of DRR Source

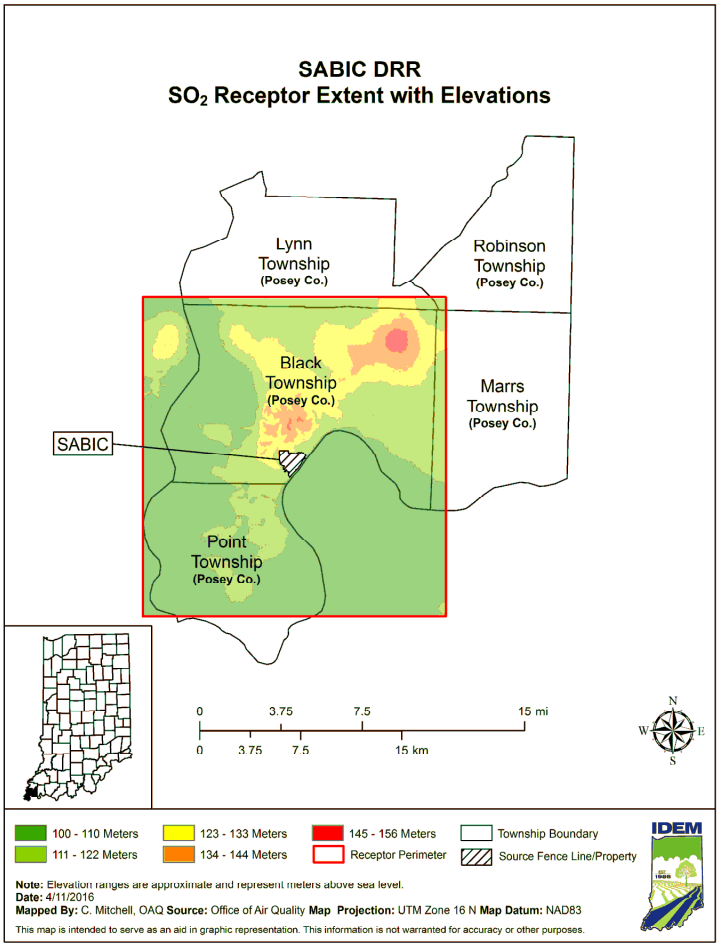
SABIC Innovative Plastics (SABIC) is a plastics manufacturing facility. SABIC makes plastics for industries such as automotive, consumer electronics and medical devices. SABIC is

currently in the process of building a cogeneration (CoGen) plant that will use natural gas instead of coal to create the majority of the steam for their operation.

Characterization of Modeled Area

SABIC is located at 1 Lexan Lane, Mt. Vernon, Indiana, less than a mile from the Ohio River in Black Township, Posey County, Indiana. A map of the area and the receptor grid used for DRR modeling is shown below in Figure 14.1.

Figure 14.1 - Map of SABIC Innovative Plastics and Surrounding Area



Model Options

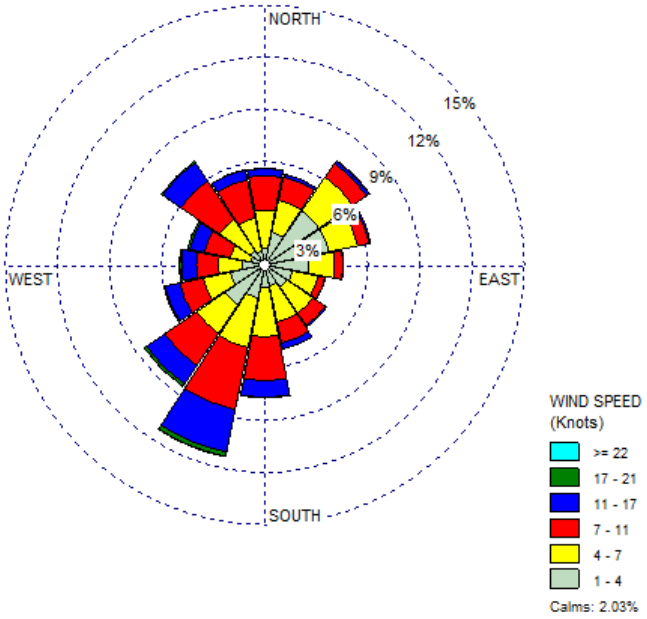
All regulatory default options within AERMOD will be used to determine the air quality characteristics surrounding SABIC. The Auer Land Use Classification Scheme was used to determine land use in the area. The area is considered primarily rural; therefore, a rural

classification was used, as provided for in the Guideline on Air Quality Models, Section 7.2.3 (EPA, 2005b). No variation of the population selection will be necessary.

Meteorology/Wind Roses

Evansville, Indiana surface meteorological data and Lincoln, Illinois upper air meteorological data for the years 2012 through 2014 will be used to determine the air quality characteristics in the area surrounding SABIC. Figure 14.2 shows the cumulative wind rose for 2012-2014 for the Evansville/Southwest Indiana area.

Figure 14.2 - Evansville 3-year Cumulative Wind Rose (2012 – 2014)



Emissions Summary for SABIC

As a result of the CoGen project, a number of SO_2 emission units will shut down. The unit that will still have significant SO_2 emissions will be the COS Vent Oxidizer. Other ancillary sources such as the liquid waste boilers will also be included in the inventory. Most of the other ancillary sources will have small SO_2 emissions but will also be included in the modeling. Their emissions will be based on fuel usage and emissions calculations taken from U.S. EPA's AP-42 emission factors. The COS Vent Oxidizer process has varying hourly emissions and will be based on the highest 1-hour performance test runs from 2009 and 2013. These performance tests

specifically tested the regeneration process among the six CO generators to determine the variability of SO_2 emissions during this process.

Modeled Inventory Sources

SO_2 sources from the surrounding area were evaluated to determine if their SO_2 emissions impact the air quality surrounding the DRR source, beyond what is captured through background monitoring data. The latest available actual emissions were input for all inventory sources. Table 14.1 lists the sources that will be included in the AERMOD run to determine overall air quality characteristics.

Table 14.1 - Posey County, Indiana
1-Hour SO_2 Modeling Source Inventories

Source	Source ID	Location	SO_2 Emissions (tpy)
CountryMark	129-00037	Posey County	477
A.B. Brown	129-00010	Posey County	9,427

Temporally Varying Seasonal 1-Hour SO_2 Background

Temporally varying seasonal 1-hour SO_2 background concentrations were taken from the Evansville – Buena Vista Road monitor and input directly into the AERMOD model run for SABIC. The hourly seasonal 1-hour SO_2 values used for representative background concentrations for the area surrounding SABIC are listed below in Table 14.2.

Table 14.2 - 99th Percentiles for Temporally Varying Seasonal SO_2 Background Values (ppb) from the Evansville – Buena Vista Road SO_2 Monitor for (2012-2014)

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	6.00	4.22	3.88	4.27	6.02	4.95	5.25	7.43
Spring	4.99	3.83	4.30	4.34	3.30	4.47	7.75	9.52
Summer	2.71	2.22	1.00	1.00	2.87	3.45	3.34	5.99
Fall	3.46	3.30	2.85	3.52	4.00	4.35	4.80	5.28

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	8.89	11.94	13.62	10.29	14.74	19.17	19.48	19.76
Spring	9.82	9.05	13.37	13.25	15.49	12.02	9.34	10.70
Summer	10.12	12.58	9.14	7.55	7.47	4.65	4.08	6.05
Fall	7.73	11.66	15.88	11.70	11.26	10.28	10.03	9.08

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	16.64	16.70	9.18	6.89	8.01	6.59	6.74	6.22
Spring	13.01	12.93	11.32	8.26	5.59	3.81	5.90	6.10
Summer	7.88	8.56	7.12	2.71	2.72	2.22	2.86	3.40
Fall	10.11	9.85	8.87	8.51	5.70	2.59	3.06	3.31

Due to the cogeneration project, several coal-fired boilers will be removed from service and overall SO_2 emissions from SABIC will be reduced. However, since this project was permitted in 2015 and the completion of construction is due to occur in the fall of 2016, SABIC may need to establish emissions limits that including the shutdown of the BW, E and H boilers that will demonstrate compliance with the 1-hour SO_2 NAAQS. IDEM will be discussing this approach with U.S. EPA.

6.0 - Hoosier Energy – Merom Generating Station (18-153-00005)

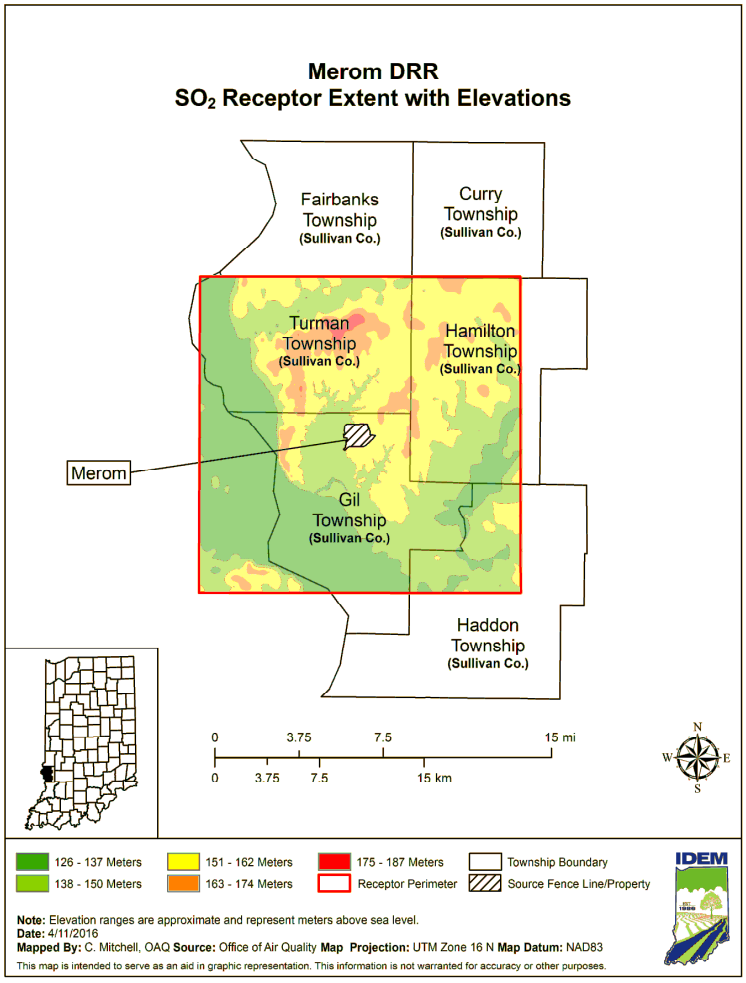
Source Description of DRR Source

Merom Generating Station (Merom Station) is a stationary electric utility generating station consisting of two units that have a generating capacity of 980 megawatts (MW) combined. Merom Station has two coal-fired boilers, each rated at 5,088 MMBtu/hr. The plant is operated by Hoosier Energy REC.

Characterization of Modeled Area

Merom Generating Station is located at 5500 West Old 54, Sullivan, Indiana in Gill Township, Sullivan County, Indiana; approximately 6 miles west of Sullivan, IN in southwest Indiana. A map of the area and the receptor grid used for DRR modeling is shown in Figure 15.1.

Figure 15.1 - Map of Merom Station and Surrounding Area



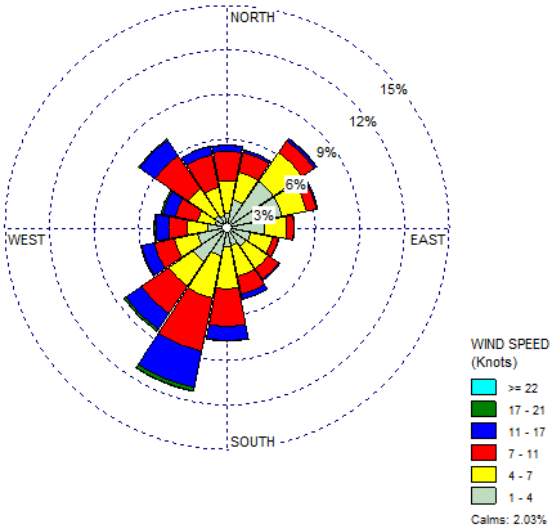
Model Options

All regulatory default options within AERMOD will be used to determine the air quality characteristics surrounding Merom Station. The Auer Land Use Classification Scheme was used to determine land use in the area. The area is considered primarily rural; therefore, a rural classification was used, as provided for in the Guideline on Air Quality Models, Section 7.2.3 (EPA, 2005b). No variation of the population selection will be necessary. Figure 15.2 shows the cumulative wind rose for 2012-2014 for the Evansville/Southwest Indiana area.

Meteorology/Wind Roses

Evansville, Indiana surface meteorological data and Lincoln, Illinois upper air meteorological data for the years 2012 through 2014 will be used to determine the air quality characteristics in the area surrounding SABIC. Figure 15.2 shows the cumulative wind rose for 2012-2014 for the Evansville/Southwest Indiana area.

Figure 15.2 – Evansville – Buena Vista 3-year Cumulative Wind Rose (2012 – 2014)



Emissions Summary for Merom Station

Merom Station has two units, Units 1 and 2, which have continuous emission monitoring (CEM) data for SO_2. This hourly CEM data from both units was formatted and used in the 1-hour SO_2 AERMOD model run.

Modeled Inventory Sources

SO_2 sources from the surrounding area were evaluated to determine if their SO_2 emissions impact the air quality surrounding the DRR source, beyond what is captured through background monitoring data. The latest available actual emissions were input for all inventory sources. The following list of sources will be included in the AERMOD run to determine overall air quality characteristics. There were no Indiana SO_2 sources with significant emissions within 30 kilometers that would be considered to have an impact on the air quality surrounding Merom Station. Illinois Environmental Protection Agency (IEPA) supplied emissions and modeling information for the Rain CII Carbon facility that falls within the 30 kilometer radius of Merom Station. Table 15.1 lists the Illinois source to be included in the AERMOD run to determine overall air quality characteristics.

Table 15.1 - Crawford County, Illinois:
1-Hour SO_2 Modeling Source Inventories

Source	Source ID	Location	2014 SO_2 Emissions (tpy)
Rain CII Carbon	33-025-AAJ	Crawford County, IL	6,180

Temporally Varying Seasonal 1-Hour SO_2 Background

Temporally varying seasonal 1-hour SO_2 background concentrations were taken from the North Lafayette Avenue, Terre Haute, Vigo County monitor and input directly into the AERMOD model run for Merom Station. Table 15.2 below lists the hourly seasonal 1-hour SO_2 values used for representative background concentrations for the area surrounding Merom Station.

Table 15.2 - 99th Percentiles for Temporally Varying Seasonal SO_2
Background Values (ppb) from North Lafayette Ave SO_2 Monitor (2012-2014)

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	4.52	4.04	5.25	3.63	4.36	3.47	2.97	4.02
Spring	4.36	5.82	3.98	4.12	3.88	3.06	4.51	4.86
Summer	1.00	1.00	1.00	1.00	1.00	1.00	1.82	3.47
Fall	3.99	4.20	4.75	3.35	3.29	2.1	2.29	2.50

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	4.05	4.98	8.47	9.50	8.17	7.42	7.67	5.63
Spring	6.70	6.02	9.42	9.67	6.35	7.42	7.03	5.49
Summer	4.02	5.55	7.70	9.00	7.78	9.28	4.82	3.98
Fall	5.02	5.164	5.4	9.72	8.39	7.30	4.57	8.68

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	5.76	8.26	5.83	7.23	6.46	5.58	5.69	5.16
Spring	6.58	6.63	5.89	4.30	3.90	3.15	3.64	5.06
Summer	2.71	3.50	5.13	3.34	1.00	4.00	2.00	2.11
Fall	4.96	5.45	5.01	3.54	7.78	4.55	6.31	5.51

7.0 - Duke – Cayuga Generating Station (18-165-00001)

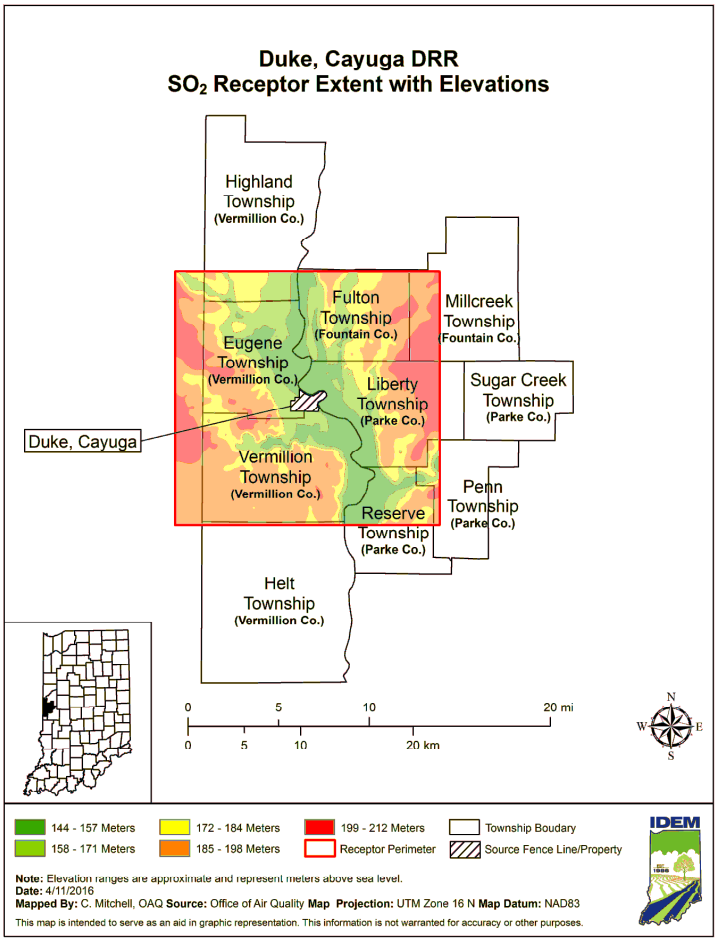
Source Description of DRR Source

The Duke - Cayuga Generating Station (Cayuga Station) is a stationary electric utility generating station consisting of two units that have a capacity to generate 1,104 megawatts (MW) of electricity combined. Cayuga Station has two coal-fired boilers that are rated at 4,802 MMBtu/hr each. The plant is operated by Duke Energy Indiana, LLC.

Characterization of Modeled Area

The Cayuga Station is located off of State Road 63, Cayuga, Indiana on the banks of the Wabash River, Eugene Township, Vermillion County, Indiana. A map of the area and the receptor grid used for DRR modeling is shown in Figure 16.1.

Figure 16.1 - Map of the Duke – Cayuga Generating Station and Surrounding Area



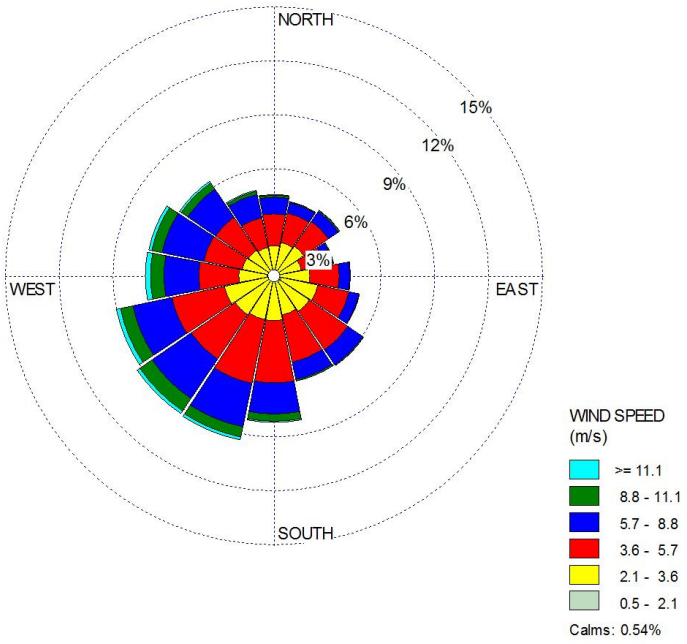
Model Options

All regulatory default options within AERMOD will be used to determine the air quality characteristics surrounding Cayuga Station. The Auer Land Use Classification Scheme was used to determine land use in the area. The area is considered primarily rural; therefore, a rural classification was used, as provided for in the Guideline on Air Quality Models, Section 7.2.3 (EPA, 2005b). No variation of the population selection will be necessary.

Meteorology/Wind Roses

Indianapolis, Indiana surface meteorological data and Lincoln, Illinois upper air meteorological data for the years 2012 through 2014 will be used to determine the air quality characteristics in the area surrounding Cayuga Station. Figure 16.2 shows the cumulative wind rose for 2012-2014 for the Central/West Central Indiana area.

Figure 16.2 - Indianapolis 3-year Cumulative Wind Rose (2012 – 2014)



Emissions Summary for Cayuga Station

Cayuga Station has two units, Units BLR1 and BLR2 that have continuous emission monitoring (CEM) data for SO_2. This hourly CEM data from both units was formatted and used in the 1-hour SO_2 AERMOD model run. The auxiliary boiler will also be modeled based on the 2014 emissions reporting.

Modeled Inventory Sources

SO_2 sources from the surrounding area were evaluated to determine if their SO_2 emissions impact the air quality surrounding the DRR source, beyond what is captured through background monitoring data. The latest available actual emissions were input for all inventory sources. The following list of sources will be included in the AERMOD run to determine overall air quality characteristics. Table 16.1 lists the inventory source to be included in the AERMOD run to determine overall air quality characteristics for the area surrounding Cayuga Station.

Table 16.1 - Vermillion County, Indiana:
1-Hour SO_2 Modeling Source Inventories

Source	Source ID	Location	2014 SO_2 Emissions (tpy)
Eli Lilly	165-00009	Vermillion County	1,851

Temporally Varying Seasonal 1-Hour SO_2 Background

Temporally varying seasonal 1-hour SO_2 background concentrations were taken from the Fountain County monitor and input directly into the AERMOD model run for Cayuga Station. Table 16.2 below lists the hourly seasonal 1-hour SO_2 values used for representative background concentrations for the area surrounding Cayuga Station.

Table 16.2 - 99th Percentiles for Temporally Varying Seasonal SO_2
Background Values (ppb) from Fountain County SO_2 Monitor for 2012-2014

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	7.76	7.52	7.00	6.49	8.00	7.00	6.00	6.51
Spring	7.69	8.00	7.55	8.00	8.00	7.53	7.54	6.56
Summer	4.50	5.00	4.00	3.48	3.42	3.00	3.00	3.00
Fall	6.58	5.62	6.00	5.00	7.56	6.57	7.18	6.55

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	8.55	9.60	9.98	9.00	9.00	8.26	7.65	8.30
Spring	8.63	9.00	10.00	8.00	8.63	9.00	9.00	7.64
Summer	6.22	7.24	8.62	8.00	9.00	8.00	6.57	6.60
Fall	6.60	6.63	9.00	8.67	8.00	7.62	9.00	8.68

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	6.00	8.42	8.62	11.00	8.00	8.18	8.85	8.00
Spring	8.00	8.00	9.00	8.60	9.00	7.00	8.00	7.38
Summer	6.58	5.56	6.58	5.00	4.00	4.00	6.52	4.00
Fall	8.63	8.14	7.55	7.56	6.48	7.53	8.00	7.53

8.0 - ALCOA – Warrick Power Plant (18-173-00002)

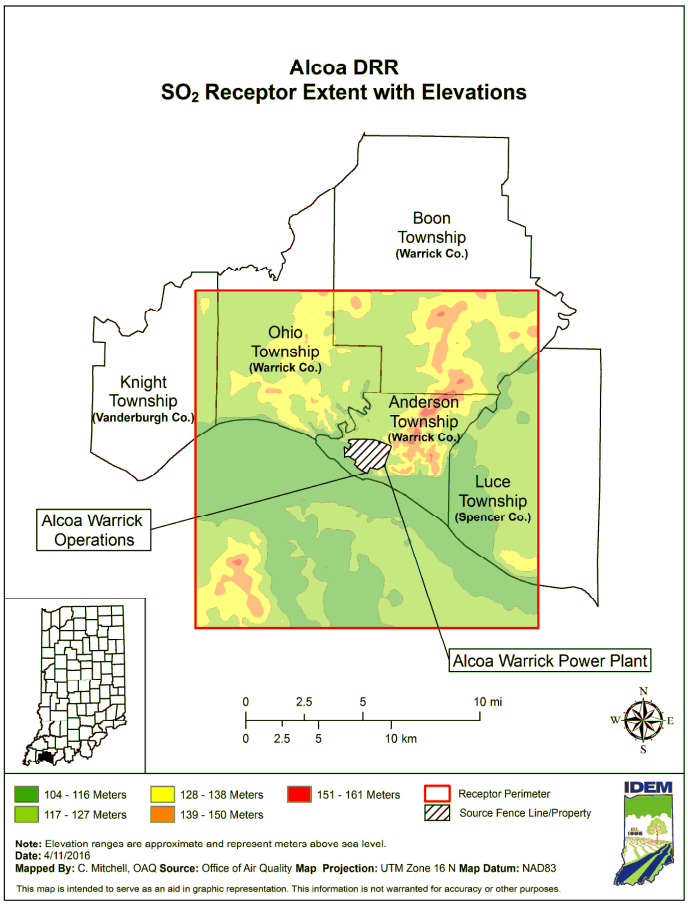
Source Description of DRR Source

The ALCOA-Warrick Power Plant (Warrick Power) is a power generating station which provides electric power for the ALCOA-Warrick Operation Aluminum smelter operations. A total of four coal fired boilers with scrubber control for SO_2 provide the power generation for the ALCOA Warrick Operations with a total heat input capacity of 7,725 MMBtu/hr.

Characterization of Modeled Area

The ALCOA-Warrick Power Plant is located along the northern bank of the Ohio River at 4700 Darlington Road, Newburgh, Indiana, in Anderson Township, Warrick County, Indiana. Figure 17.1 shows the property boundary of the Warrick Power Plant and the extent of the 10 kilometer modeling receptor grid into nearby townships and adjacent areas of northern Kentucky on the southern bank of the Ohio River.

Figure 17.1 - Map of ALCOA Warrick Power Plant and Surrounding Area



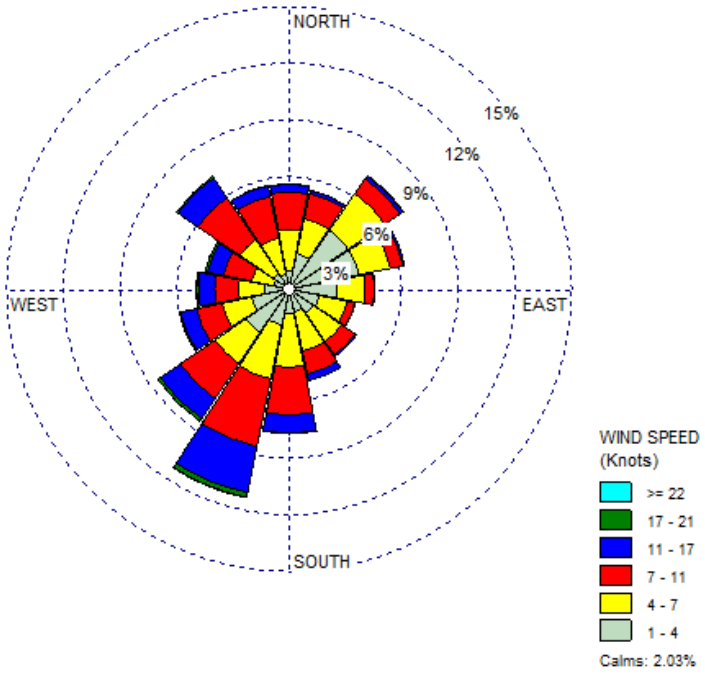
Model Options

Warrick Power will propose to use the adjustment to the surface friction velocity, (adj_U*), AERMET beta option in their modeling analysis. This will provide better model performance. Otherwise, all other regulatory default options will be selected to perform the air quality analysis for the area surrounding Warrick Power. The Auer Land Use Classification Scheme was used to determine land use in the area. The area is considered primarily rural; therefore, a rural classification was used, as provided for in the Guideline on Air Quality Models, Section 7.2.3 (EPA, 2005b). No variation of the population selection will be necessary.

Meteorology/Wind Rose

The Evansville National Weather Service (NWS) surface meteorological data and the Lincoln, Illinois upper air meteorological data taken from 2012 through 2014 will be used to determine the meteorological conditions for the area surrounding Warrick Power in AERMOD. The Evansville NWS wind rose for the 3-year modeled period 2012-2014 is shown as Figure 17.2 below. The Evansville NWS wind rose depicts the predominate wind direction as from the southwest for the 3-year modeled period 2012-2014.

Figure 17.2 - Evansville 3-year Cumulative Wind Rose (2012 – 2014)



Emissions Summary for ALCOA Warrick Power Plant

Warrick Power will be modeled with 2012-2014 continuous emissions monitoring data (CEM) across the three year period. Boiler units 1, 2, and 3 will be modeled through a common stack and boiler unit 4 will be modeled as a separate stack. In addition, since the Vectren F.B. Culley Generating Station is located next door to Warrick Power, the Culley Generating Station will be evaluated with Warrick Power to determine the air quality characteristics of the area.

Modeled Inventory Facilities

SO_2 sources from the surrounding area were evaluated to determine if their SO_2 emissions impact the air quality surrounding the DRR source, beyond what is captured through background monitoring data. The latest available actual emissions were input for all inventory sources. The following list of sources will be included in the AERMOD run to determine overall air quality characteristics. Table 17.1 lists the 2014 emissions from the inventory sources in Indiana and Kentucky to be included in the AERMOD run to determine overall air quality characteristics for the area surrounding Warrick Power Plant.

Table 17.1 –Warrick and Spencer Counties in Indiana and Daviess and Hancock Counties in Kentucky: 1-Hour SO_2 Modeling Inventory

Source	Source ID	Location	2014 SO_2 Emissions (tpy)
Vectren F.B. Culley Generating Station Units 2 and 3	18-173-00001	Warrick County, IN	2012-2014 Hourly CEMS Data
AEP Rockport Power Boiler Units 1 and 2	18-147-00020	Spencer County, IN	54,979
Owensboro Municipal Utilities Elmer Smith Station	21-059-00027	Daviess County, KY	8,064
Big Rivers Electric Corporation Coleman Station	21-091-00003	Hancock County, KY	8,146
Century Aluminum of KY LLC	21-091-00004	Hancock County, KY	2,088
Owensboro Grain Company	21-059-00039	Daviess County, KY	382

Temporal Varying Seasonal 1-Hour Seasonal SO_2 Background

Temporally varying seasonal 1-hour SO_2 background concentrations were taken from the Evansville Buena Vista Road (18-163-0021), Vanderburgh County SO_2 monitor and input directly into the AERMOD model for Warrick Power. Table 17.2 shows the hourly seasonal 1-

hour SO_2 concentrations in parts per billion (ppb) which represents the background concentrations for the area surrounding Warrick Power.

Table 17.2 - 99th Percentile Temporally Varying Seasonal SO_2 Background Concentrations (ppb) from Evansville Buena Vista SO_2 Monitor (2012-2014)

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	6.00	4.25	3.81	4.20	5.75	4.76	5.66	7.41
Spring	4.48	3.87	3.57	4.06	2.91	3.31	4.47	8.25
Summer	2.37	2.38	1.00	1.00	3.60	3.90	3.83	4.26
Fall	2.23	2.28	2.22	3.20	3.54	3.00	3.99	5.26

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	8.86	10.80	12.58	10.87	14.64	19.51	19.33	19.31
Spring	8.36	8.89	13.01	11.98	8.85	11.87	10.46	12.29
Summer	5.55	12.12	8.41	8.80	5.72	4.40	4.81	5.27
Fall	7.56	11.32	11.34	11.68	10.07	10.39	7.16	7.79

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	15.65	17.13	9.25	10.40	8.60	8.35	6.29	6.12
Spring	12.28	13.04	11.68	8.29	5.26	3.81	5.76	6.06
Summer	6.35	9.76	7.11	4.74	4.04	2.21	3.04	1.00
Fall	10.68	10.11	6.67	4.68	4.42	2.59	2.80	2.79

9.0 - ALCOA – Warrick Operations (18-173-00007)

Source Description of DRR Source

ALCOA - Warrick Operations is an aluminum smelter operation with SO_2 stack emissions from smelter potlines and line source emissions vented through smelter potline rooms. Additionally, there are SO_2 emissions from an anode baking ring furnace. The ALCOA – Warrick Operations aluminum smelter ceased operations on March 31, 2016, with only the rolling mill continuing to operate (see ALCOA press release dated January 7, 2016). An extremely small amount of SO_2 emissions will occur from the operation of the rolling mill due to natural gas combustion, however, it is anticipated the total annual SO_2 emissions from the entire ALCOA Warrick Operations will be less than one ton per year. As a result, the DRR will be addressed by ALCOA Warrick Operations with a signed revocation of their Part 70 operating permit for the smelting operations.

Summary

Due to the fact that the main SO_2 emission source for Alcoa – Warrick Operations was the smelter and the smelting operations were permanently shut down on March 31, 2016, IDEM will provide documentation to demonstrate the smelter is in fact permanently shut down and will not restart at a future date. The area will be characterized by air dispersion modeling for the Alcoa – Warrick Power Plant which includes the Vectren – F.B. Culley Generating Station.

10.0 - Isolatek (18-069-00021)

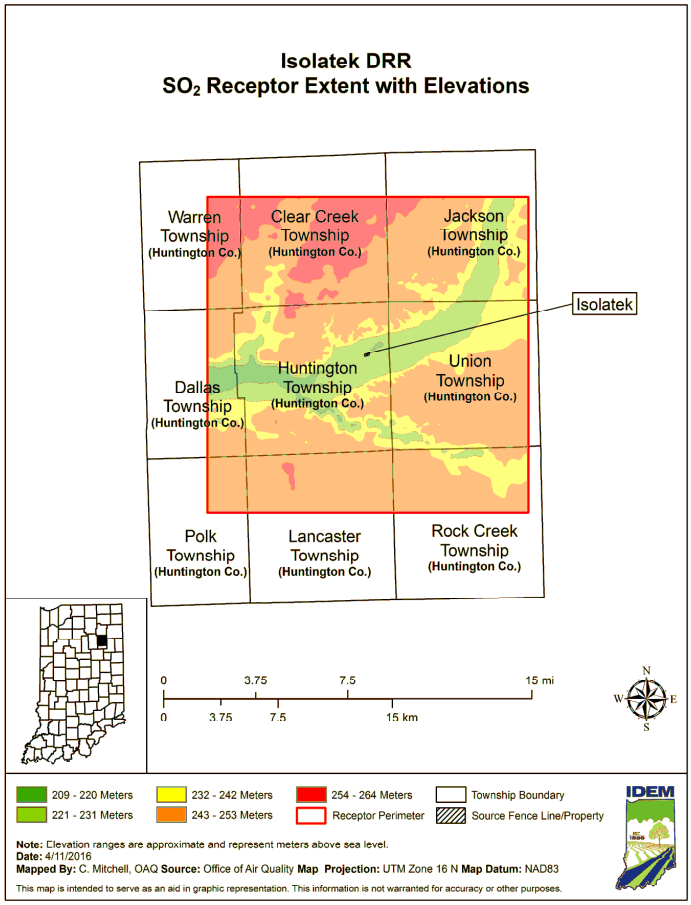
Source Description of DRR Source

Isolatek (aka U.S. Minerals) is a stationary acoustic and thermal insulation manufacturing plant. There are two short stack cupolas, two blow chambers, process lines, baggers and blenders. While IDEM did not initially list Isolatek on the state list of DRR sources due to annual SO_2 emissions well below 2,000 tons, U.S. EPA has concerns about air quality in the vicinity of the source and requested the facility be listed.

Characterization of Modeled Area

Isolatek is located at 701 North Broadway Street, Huntington, in Huntington Township, Huntington County, Indiana. Figure 19.1 below shows the property boundary of the Isolatek facility and the extent of the 10 kilometer modeling receptor grid into nearby townships and adjacent areas.

Figure 19.1 - Map of Isolatek and Surrounding Area



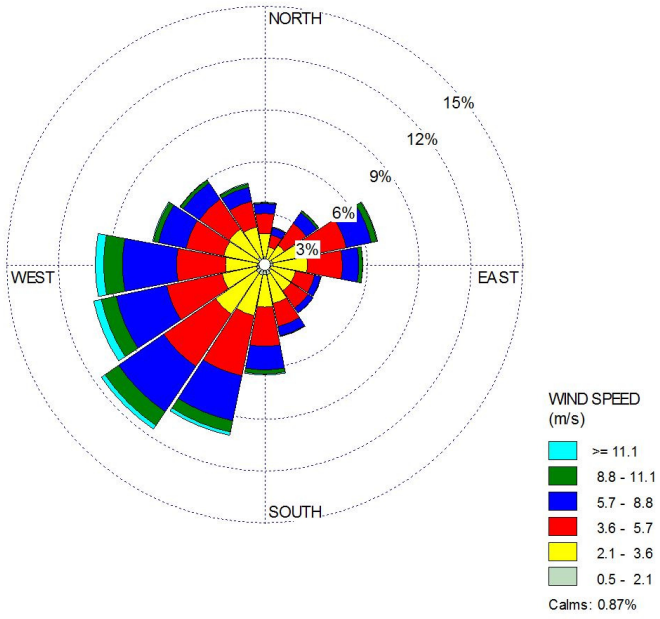
Model Options

Isolatek will use the regulatory default options for the air quality modeling analysis. The Auer Land Use Classification scheme was used to determine the urban versus rural option in AERMOD. It was determined the land use classification for an area within a three kilometer radius surrounding the Isolatek facility was primarily a rural classification.

Meteorology/Wind Rose

The 2012 through 2014 Fort Wayne National Weather Service (NWS) surface meteorological data and the Wilmington, Ohio upper air meteorological data will be used to determine the meteorological conditions for the area surrounding the Isolatek facility in AERMOD. The Fort Wayne NWS wind rose for the 3-year modeled period 2012-2014 is shown as Figure 19.2 below. The Evansville NWS wind rose depicts the predominate wind direction as from the southwest and west - southwest for the 3-year modeled period 2012-2014.

Figure 19.2 - Fort Wayne 3-year Cumulative Wind Rose (2012 – 2014)



Emissions Summary for Isolatek

Isolatek will be modeled using an average of the 2012-2014 emissions data across the three year period. Cupola 1 and 2 and the two blow chambers emissions will be based on reported emissions and stack test information, where applicable.

Modeled Inventory Facilities

Table 19.1 lists the nearby SO_2 facility from Whitley County to be included in the air quality modeling analysis to determine the overall SO_2 air quality impact in the area surrounding Isolatek. The SO_2 emissions listed are the 2014 actual annual emissions.

Table 19.1 – Whitley County, Indiana:
1-Hour SO_2 Modeling Source Inventories

Source	Source ID	Location	SO_2 Emissions (tpy)
Steel Dynamics Inc	18-183-00030	Whitley County, IN	146.9

Temporal Varying Seasonal 1-Hour Seasonal SO_2 Background

Temporally varying seasonal 1-hour SO_2 background concentrations were taken from the Larwill (18-183-0003), Whitley County SO_2 monitor and input directly into the AERMOD model for Isolatek. Table 19.2 shows the hourly seasonal 1-hour SO_2 concentrations in parts per billion (ppb) which represents the background concentrations for the area surrounding Isolatek.

Table 19.2 – 99th Percentile Temporally Varying Seasonal SO_2 Background Concentrations (ppb) from Larwill, Whitley County SO_2 Monitor (2013-2015)

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	3.78	4.48	4.38	3.80	3.50	3.06	4.72	3.20
Spring	3.13	3.40	3.43	3.20	3.30	3.23	3.00	3.40
Summer	1.00	1.00	1.00	1.00	1.00	1.00	2.17	2.67
Fall	1.00	1.00	1.00	2.25	1.37	1.00	1.56	1.30

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	3.76	3.80	4.54	4.76	5.18	6.20	5.20	5.04
Spring	3.70	3.60	3.57	3.57	3.24	3.10	3.46	3.20
Summer	3.17	3.00	3.20	2.60	2.17	1.00	1.00	1.00
Fall	2.47	3.14	2.57	2.94	3.11	3.00	1.41	1.00

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	4.30	3.74	3.56	3.04	2.94	3.08	2.98	3.40
Spring	2.53	2.80	2.50	2.53	2.60	2.93	3.13	3.50
Summer	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fall	1.00	1.00	1.00	1.00	1.37	1.00	1.00	1.00

Appendix B

1-Hour SO_2

Background Determination

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Indiana's 1-Hour SO_2 Background Determination

U.S. EPA revised the SO_2 National Ambient Air Quality Standard (NAAQS) by instituting a 1-hour primary standard of 75 parts per billion (ppb). Therefore, an analysis was necessary to determine ambient 1-hour SO_2 background concentrations representative for all regions in the state. This determination is needed in order to make attainment designations, attainment demonstrations and perform New Source Review (NSR) and Prevention of Significant Deteoriation (PSD) modeling. Indiana has reviewed the 1-hour SO_2 monitoring and meteorological data from 2012 through 2014 to calculate representative ambient 1-hour SO_2 background concentrations. U.S. EPA's "SO_2 NAAQS Designations Modeling Technical Assistance Document, December 2013" was followed to calculate the background concentrations in order to eliminate overly conservative cumulative impacts from nearby major SO_2 emission sources when performing air quality dispersion modeling.

Overview

Indiana has 21 SO_2 monitors located throughout the state. Table 1 shows the 99th percentile for the years 2012, 2013, 2014, and 2015 and the 2012-2014 and 2013-2015 1-hour SO_2 design values for the 7 SO_2 monitors that the attainment designation are based on.

Table 1. 1-Hour SO_2 Design Values for SO_2 Monitors (ppb) in Indiana

County	Monitor ID	99th Percentile				2012-2014 Design Value	2013-2015 Design Value
		2012	2013	2014	2015		
Floyd	18-043-1004	32.0	20.5	43.8	26.0	32	30
Fountain	18-045-0001	30.0	34.0	22.0	19.0	29	25
Jasper	18-073-0002	33.0	40.0	18.0	10.0	30	23
Lake	18-089-0022	47.0	43.2	53.1	35.0	48	44
Porter	18-127-0011	36.0	36.0	27.0	39.0	33	34
Vanderburgh	18-163-0021	16.5	18.6	32.3	18.0	22	23
Vigo	18-167-0018	72.5	79.1	85.0	71.0	79	78
Whitley	18-183-0003	N/A	5.8	13.3	12.0	N/A	10

N/A – Not Available

Data Retrieval

Monitoring data for the SO_2 monitors near the DRR sources were retrieved from U.S. EPA's AirData database. The concentration data were supplied for each hour and day of every month from 2012 through 2014. Meteorological data was collected in order to correlate the wind directions and concentrations for each hour of each day of every month. Meteorological data

was either collected at a monitor near the monitoring site or the nearest National Weather Service (NWS) station or Automated Surface Observation Stations (ASOS). This data was collected and distributed by the Midwest Regional Climate Center (mrcc.isws.illinois.edu). The nearest meteorological data to each of the SO_2 monitors is summarized below.

Table 2. Locations of SO_2 Monitors and Meteorological Stations for Background Analysis

County/Site	Monitor ID	Monitor Location	Meteorological Station	Station Location
Floyd Co. / New Albany	18-043-1004	38.31° N 85.83° W	Charlestown State Park meteorological station	38.39° N 85.66° W
Fountain Co. / North of S.R. 234	18-045-0001	39.96° N 87.42° W	Indianapolis NWS station	39.79° N 86.18° W
Jasper Co. / Wheatfield	18-073-0002	41.19° N 87.05° W	South Bend NWS station	41.69° N 86.25° W
Lake Co. / Gary IITRI	18-089-0022	41.72° N 86.91° W	Gary IITRI meteorological station	41.61° N 87.30° W
Porter Co. / Dunes Acres	18-127-0011	41.63° N 87.10° W	Gary IITRI meteorological station	41.61° N 87.30° W
Vanderburgh Co. / Buena Vista	18-063-0021	38.01° N 87.58° W	Evansville NWS station	38.05° N 87.52° W
Vigo Co. / Lafayette Ave	18-167-0018	39.49° N 87.40° W	Indianapolis NWS station	39.79° N 86.18° W
Whitley Co. / Larwill	18-183-0003	41.17° N 85.63° W	Fort Wayne NWS station	40.98° N 85.20° W

Methodology for Determining Ambient SO_2 Background Concentrations

Each set of SO_2 data was paired with the corresponding meteorological conditions for every hour of the year in order to determine the wind direction for each hour that SO_2 concentrations were recorded. Data was processed in chronological order with daily and seasonal trends analyzed.

The initial analysis created pollution roses to determine the wind directions from which the highest SO_2 concentrations were coming. This analysis helped to identify the nearest upwind SO_2 emission sources impacting the SO_2 monitor. With those wind directions identified, SO_2 concentrations (10 ppb and above) resulting from SO_2 emission sources from those wind directions were removed from the analysis, in order to calculate a representative ambient SO_2 background concentration for each SO_2 monitor. This analysis helps to prevent double-counting SO_2 emission source impacts in an air quality modeling analysis. Once data for the SO_2 monitors were processed, the data was re-formatted in order to calculate the hourly-seasonal 99th

percentile averages over a 3-year period, as detailed in U.S. EPA's "SO_2 NAAQS Designations Modeling Technical Assistance Document, December 2013 Section 8 – Background Concentrations". The 99th percentile concentrations, based on each hour of the day and each of the four seasons of the year, were calculated for each SO_2 monitor.

In order to calculate the seasonal hourly 99th percentile average, the data was grouped by the seasonal months. Spring was represented by concentrations recorded in March, April and May; summer represented by June, July and August; fall represented by September, October and November and winter represented by December, January and February. Once this data was grouped by seasons, the 99th percentile was calculated for each hour of the day, making 24 separate 99th percentiles for each SO_2 monitoring site per season. The average of these 99th percentiles over the three-year period represents the hourly-seasonal 1-hour SO_2 background.

Summary

For purposes of the modeling analysis related to the DRR, adjusted 1-hour SO_2 background values were used for the Posey, Warrick, Floyd, Sullivan, Vermillion, Jasper, Lake, Porter and Huntington counties DRR sources. Calculations to determine adjusted 1-hour SO_2 background concentrations were made according to U.S. EPA's "SO_2 NAAQS Designations Modeling Technical Assistance Document, February 2016 Section 8 – Background Concentrations". This approach calls for the removal of SO_2 concentrations emitted from large SO_2 emission sources located directly upwind of a SO_2 monitor. This allows for more representative ambient background values to be determined, not overly conservative values that could possibly double-count direct SO_2 source impacts and 1-hour SO_2 background concentrations when modeling inventory sources.